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Research and Development in Industry: 1991

Funds, 1991
Scientists & Engineers, January 1992

Detailed Statistical Tables

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Contributors

Data collection, preparation, and tabulations were performed by the Bureau of the Census, Department of Commerce, for the National Science Foundation. The principal author for this report was Raymond M. Wolfe.

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GENERAL NOTES

The Survey of Industrial Research and Development provides national estimates of the total expenditures on research and development (R&D) performed within the United States by industrial firms, whether U.S. or foreign owned. It is a sample survey in which all R&D-performing companies, including privately held firms, are intended to be included or represented. All companies that are identified as spending more than $1 million annually on R&D in the United States receive a survey form every year. Information from individual companies in the sample is used to develop national estimates on an industry-by-industry basis. The survey does not cover trade associations. Although their primary mission is to serve industry, these associations are established as nonprofit organizations, and it is estimated that their R&D expenditures are less than 1 percent of the industry R&D total.

The survey is enterprise based rather than establishment based. Therefore, all R&D data for each enterprise are reported in the major Standard Industrial Classification (SIC) code of the firm. Data are aggregated in this manner for all tables in this report.

For surveys up to and including the 1991 survey, data are based on probability samples selected about every 5 years. In intervening years a subset of the last sample, called a "panel," is used. The most recent probability sample prior to the 1991 survey was selected and first used for survey year 1987.

The Bureau of the Census (Census), Department of Commerce, has conducted the survey annually for the National Science Foundation (NSF) since 1957. Census staff conduct the survey under title 13 of the U.S. Code, which prohibits publication or release of data that may reveal information about individual companies. Therefore, on some tables of this report, the symbol "(D)" is used as a footnote reference to indicate that data are being withheld to avoid possible disclosure of information about operations of individual companies.

For detailed discussions of the history of the survey, survey methodology, comparability of data, and survey definitions, see section B. For more information regarding the survey, please contact Raymond Wolfe:

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Note

To obtain accurate historical statistics, use only the latest detailed statistical tables in this report and not those published earlier. Statistics in trend tables are derived from the most recently completed survey cycle. Data for prior years are reviewed for consistency with current-year responses and are revised when necessary. Consequently, this report contains the latest revised statistics from the Survey of Industrial Research and Development.

SECTION A. DETAILED STATISTICAL TABLES

Classification of Reporting Units

The basic reporting unit is the company or corporate family that includes all establishments under common ownership or control. All research and development (R&D) expenditures and all scientists and engineers of each company are classified into a single standard industrial classification (SIC) code and size category. An exception is made for most of the companies classified in SIC code 13 (oil and gas extraction) and SIC code 50 (wholesale trade, durable goods). Because the R&D activity of these companies is in manufacturing product areas rather than in service areas, their R&D expenditures are included with the SIC classifications of the manufacturing codes that encompassed the highest dollar value of these companies' payroll. The R&D expenditures of all such firms in SIC 13 are included with those of the firms in SIC 29 (petroleum). The R&D expenditures of such firms in SIC 50 are allocated to several manufacturing SIC codes.

Company Size-Class

Companies are categorized by their total number of domestic employees. The following are the six company size-classes used in this report:

1. Fewer than 500 employees;
2. 500 to 999 employees;
3. 1,000 to 4,999 employees;
4. 5,000 to 9,999 employees;
5. 10,000 to 24,999 employees; and
6. 25,000 or more employees.

Current/Constant Dollars

Statistics in all tables are reported in terms of current dollars. Constant dollars are also presented in two summary trend tables, tables A-1 and A-25.

Geographic Statistics

The statistics cover only those operations in the 50 States and the District of Columbia. Company-sponsored R&D performed outside the United States by foreign subsidiaries of U.S. domestic companies is reported in table A-11 but is excluded from all other tables.

Industry Classification

Census assigned an enterprise-level SIC code to each company. A single SIC code was assigned to multiestablishment companies based on the code that represented the most dominant aggregated activity for that firm in terms of total payroll. Data for the following industry groupings are published in this report (SIC code(s) are shown in parentheses):[1]

Food and tobacco (20, 21)[2]
Textiles and apparel (22, 23)
Lumber, wood products, and furniture (24, 25)
Paper and allied products (26)
Chemicals and allied products (28)
    Industrial chemicals (281-82, 286)
    Drugs and medicines (283)
    Other chemicals (284-85, 287-89)
Petroleum refining and extraction (13, 29)
Rubber products (30)
Stone, clay, and glass products (32)
Primary metals (33)
    Ferrous metals and products (331-32, 3398-99)
    Nonferrous metals and products (333-36)
Fabricated metal products (34)
Machinery (35)
    Office, computing, and accounting machines (357)
    Other machinery, except electrical (351-56, 358-59)
Electrical equipment (36)
    Radio and TV receiving equipment (365)
    Communication equipment (366)
    Electronic components (367)
    Other electrical equipment (361-64, 369)

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[1] When the sample was drawn in 1987, the 1972 SIC code numbers were in effect.

[2] Until 1984, the tobacco products industry (SIC 21) was included with "other manufacturing industries."

- Transportation equipment (37)
    - Motor vehicles and motor vehicles equip. (371)
    - Other transportation equipment (373-75, 379)
    - Aircraft and missiles (372, 376)[3]
- Professional and scientific instruments (38)
- Scientific & mechanical measuring instru. (381-82)
    - Optical, surgical, photo., & other instru. (383-87)
- Other manufacturing industries—printing and publishing (27), leather products (31), and miscellaneous manufacturing industries (39)[2]
- Nonmanufacturing industries—mining (10-11, 14); construction (15-17); transportation, communications, electric, gas, and sanitary services (40-42, 44-49);
  wholesale and retail trade (50-51, 53-54, 56); finance, insurance, and real estate (60, 62-63); personal and business services (72-73); motion pictures (78); health services (806-07); and engineering, accounting, research, management, and related services (87)

Percentages

Percentages were calculated on the basis of thousands of dollars and may differ from those based on the rounded figures shown.

Rounding

Because of rounding, detail may not add to totals shown.

Suppression of Statistics

Census conducts the survey under title 13 of the U.S. Code, which prohibits publication or release of data that may reveal information about individual companies. Also, missing data are imputed for some data items. Therefore, data in some of the table cells may have been deleted and replaced with one of the following notations:

> "(D)," which indicates that data are being withheld to avoid possible disclosure of information about operations of individual companies. This suppression occurs when a small number of companies, usually one or two, account for a large percentage of the R&D funds or of scientists and engineers in a particular data cell. The tables most often affected by this rule are those that contain data on Federal support to companies for R&D performance.
>
> "(S)," which indicates that the imputation rate—the percentage of the statistic not reported by respondents and consequently estimated by Census—exceeds 50 percent for that item. See table B-3 in section B for imputation rates for specific items.

Although publication of statistics may be withheld from certain cells, these statistics are always included in totals. In some instances statistics withheld because of high imputation rates (footnote reference "(S)") can be derived by subtraction from higher level totals. In such cases the user should be aware that the derived numbers are statistically unreliable. In no instance can statistics be derived that would disclose operations of individual companies (footnote "(D)").

---

[3] Because of the close similarity of their R&D activities, companies primarily engaged in the manufacture of ordnance and accessories, including complete guided missiles, are grouped with companies primarily engaged in the manufacture of aircrafts and parts.

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[Dollars in millions]

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Year	Total R&D		Federal		Company 1/	
	Current dollars	Constant 1987 dollars	Current dollars	Constant 1987 dollars	Current dollars	Constant 1987 dollars
1953	3,630	16,500	1,430	6,500	2,200	10,000
1954	4,070	18,333	1,750	7,883	2,320	10,450
1955	4,640	20,262	2,180	9,520	2,460	10,742
1956	6,605	27,987	3,328	14,102	3,277	13,886
1957	7,731	31,684	4,335	17,766	3,396	13,918
1958	8,389	33,691	4,759	19,112	3,630	14,578
1959	9,618	37,570	5,635	22,012	3,983	15,559
1960	10,509	40,419	6,081	23,388	4,428	17,031
1961	10,908	41,475	6,240	23,726	4,668	17,749
1962	11,464	42,617	6,434	23,918	5,029	18,695
1963	12,630	46,434	7,270	26,728	5,360	19,706
1964	13,512	48,780	7,720	27,870	5,792	20,910
1965	14,185	49,947	7,740	27,254	6,445	22,694
1966	15,548	52,884	8,332	28,340	7,216	24,544
1967	16,385	54,076	8,365	27,607	8,020	26,469
1968	17,429	54,808	8,560	26,918	8,869	27,890
1969	18,308	54,814	8,451	25,302	9,857	29,512
1970	18,067	51,327	7,779	22,099	10,288	29,227
1971	18,320	49,380	7,666	20,663	10,654	28,717
1972	19,552	50,392	8,017	20,662	11,535	29,729
1973	21,249	51,450	8,145	19,722	13,104	31,729
1974	22,887	50,973	8,220	18,307	14,667	32,666
1975	24,187	49,161	8,605	17,490	15,582	31,671
1976	26,997	51,620	9,561	18,281	17,436	33,338
1977	29,825	53,354	10,485	18,757	19,340	34,597
1978	33,304	55,231	11,189	18,556	22,115	36,675
1979	38,226	58,271	12,518	19,082	25,708	39,189
1980	44,505	62,071	14,029	19,566	30,476	42,505
1981	51,810	65,665	16,382	20,763	35,428	44,902
1982	58,650	69,988	18,545	22,130	40,105	47,858
1983	65,268	74,849	20,680	23,716	44,588	51,133
1984	74,800	82,198	23,396	25,710	51,404	56,488
1985	84,239	89,236	27,196	28,809	57,043	60,427
1986	87,823	90,633	27,891	28,783	59,932	61,849
1987	92,155	92,155	30,752	30,752	61,403	61,403
1988	97,889	94,215	32,117	30,911	65,772	63,303
1989	101,854	93,875	31,292	28,841	70,562	65,034
1990	104,606	92,408	30,626	27,055	73,980	65,353
1991	102,246	86,796	25,308	21,484	76,938	65,312
1992 (NSF est.)	107,800	89,165	28,800	23,821	79,000	65,343
1993 (NSF est.)	112,300	90,711	31,000	25,040	81,300	65,670

1/ Company funds include funds for industrial R&D work performed within company facilities from all sources except the Federal Government. The funds may be the companies' own or from outside organizations such as research institutions, universities and colleges, other nonprofit organizations, other companies, and State governments. Company-financed R&D not performed within the company is excluded.

NOTE: The 1987 gross domestic product implicit price deflator was used to convert current dollars to constant dollars.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-2. Selected data for R&D-performing companies, by industry: 1990-91

Page 1 of 2

Industry 1/	SIC code	Research and development funds						Domestic net sales		R&D scientists & engineers		Domestic employment	
										[In thousands]			
		Total		Federal		Company				January 2/		March	
		1990	1991	1990	1991	1990	1991	1990	1991	1991	1992	1990	1991
		[Dollars in millions]											
Total		104,606	102,246	30,626	25,308	73,980	76,938	2,655,421	2,606,922	704.1	683.7	16,888	16,071
Food and kindred products	20	(D)	812	(D)	0	789	812	184,960	185,992	(S)	(S)	1,077	1,095
Tobacco products	21	519	548	0	0	519	548	60,187	63,183	2.9	2.9	233	223
Textile mill products	22	194	169	0	0	194	169	48,280	38,792	(S)	(S)	409	367
Apparel	23	(D)	(D)	(D)	(D)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Lumber and wood products, except furniture	24	51	42	0	0	51	42	(S)	9,791	(S)	(S)	(S)	(S)
Furniture and fixtures	25	132	118	0	0	132	118	14,821	13,669	(S)	(S)	170	162
Paper and allied products	26	730	715	0	0	730	715	92,063	89,753	6.5	6.7	543	541
Printing, publishing, and allied industries	27	(D)	(D)	(D)	(D)	214	175	29,311	29,521	1.7	1.9	229	227
Chemicals and allied products	28	12,344	13,183	67	89	12,277	13,094	220,011	229,413	78.8	82.2	1,071	1,059
Petroleum refining and extraction	13,29	2,129	2,245	(S)	10	2,113	2,235	215,184	201,489	10.0	9.7	410	410
Rubber products	30	(D)	(D)	(D)	(D)	730	694	41,729	38,532	(S)	(S)	(S)	(S)
Leather and leather products	31	10	9	0	0	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Stone, clay, and glass products	32	(D)	(D)	(D)	(D)	894	895	36,908	34,977	8.3	8.1	297	272
Primary metals	33	(D)	836	(D)	17	801	819	81,247	75,138	(S)	(S)	430	422
Fabricated metal products	34	778	756	134	130	644	626	(S)	(S)	(S)	(S)	(S)	(S)
Machinery	35	14,696	15,089	916	1,055	13,780	14,034	165,362	152,840	107.0	95.4	1,359	1,202
Electrical equipment	36	17,723	17,279	5,592	4,824	12,131	12,455	258,447	262,266	137.7	(S)	1,901	1,819
Transportation	37	36,019	32,091	21,027	16,217	14,992	15,874	411,587	391,644	167.8	164.1	2,451	2,132
Professional and scientific instruments	38	6,194	6,621	99	100	6,095	6,521	79,826	83,606	40.2	(S)	585	578
Miscellaneous manufacturing industries	39	(D)	(D)	(D)	(D)	248	229	10,417	9,519	(S)	(S)	(S)	83
Communication services	48,part 737	(D)	(D)	(D)	(D)	623	557	103,572	109,084	5.6	4.8	647	675
Electric, gas, and sanitary services	49	244	278	15	19	229	259	199,446	205,057	1.7	1.5	608	596
Computer programming, data processing, other computer-related engineering, architectural, and surveying services	part 737,871	4,629	4,784	1,489	1,550	3,140	3,234	42,770	44,037	(S)	(S)	444	451

See explanatory information and SOURCE at end of table.

Table A-2. Selected data for R&D-performing companies, by industry: 1990-91

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Industry 1/	SIC code	Research and development funds						Domestic net sales		R&D scientists & engineers [In thousands]		Domestic employment [In thousands]	
		Total		Federal		Company				January 2/		March	
		1990	1991	1990	1991	1990	1991	1990	1991	1991	1992	1990	1991
		[Dollars in millions]											
Hospitals and medical and dental laboratories	806-07	192	229	3	2	189	227	6,151	6,360	(S)	(S)	1,015	1.005
Research, development, and testing services	873	1,335	1,347	415	372	920	975	24,502	24,876	12.1	9.3	65	55
Other nonmanufacturing industries	10-11,14-17,40-42,44-47,50-51,53-54,56,60,62-63,72-73,78,872,874	(D)	(D)	(D)	(D)	1,487	1,574	(S)	226,459	28.0	19.6	1,594	1,497

1/ Industries, industry groups, and product fields shown separately are classified according to the 1987 Standard Industrial Classification (SIC) manual codes.
2/ Data recorded in January represent employment figures for the previous year.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-3. Total (company, Federal, and other) funds for industrial R&D performance, by industry and size of company: 1981-91

[Dollars in millions]

Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total		51,810	58,650	65,268	74,800	84,239	87,823	92,155	97,889	101,854	104,606	102,246
Distribution by industry:												
Food, kindred, and tobacco products 1/	20-21	(D)	(D)	(D)	(D)	(D)	(D)	1,206	(D)	(D)	(D)	1,360
Textiles and apparel	22-23	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Lumber, wood products, and furniture	24-25	161	159	152	143	147	144	137	(D)	172	183	160
Paper and allied products	26	(D)	566	(D)	(D)	(D)	(D)	(D)	(D)	686	730	715
Chemicals and allied products	28	5,625	6,604	7,185	7,927	8,540	8,843	9,635	10,772	11,466	12,344	13,183
Industrial chemicals	281-82,286	2,802	3,206	3,214	3,240	3,498	3,552	3,716	3,959	4,039	4,337	4,433
Drugs and medicines	283	(D)	(D)	(D)	(D)	(D)	3,658	(D)	4,746	(D)	(D)	(D)
Other chemicals	284-85,287-89	(D)	(D)	(D)	(D)	(D)	1,633	(D)	2,067	(D)	(D)	(D)
Petroleum refining and extraction	13,29	(D)	(D)	(D)	(D)	(D)	(D)	1,897	1,944	2,066	2,129	2,245
Rubber products	30	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Stone, clay, and glass products	32	(D)	(D)	(D)	(D)	(D)	950	995	(D)	(D)	(D)	(D)
Primary metals	33	878	987	1,085	(D)	(D)	(D)	730	663	749	(D)	836
Ferrous metals and products	331-32,3398-99	(D)	(D)	(D)	(D)	(D)	(D)	(D)	258	(D)	(D)	(D)
Nonferrous metals and products	333-36	(D)	(D)	(D)	336	416	458	(D)	405	(D)	(D)	(D)
Fabricated metal products	34	624	625	701	842	829	895	783	829	800	778	756
Machinery	35	6,818	8,078	9,027	10,504	12,216	(D)	(D)	(D)	14,635	14,696	15,089
Office, computing, and accounting machines	357	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other machinery, except electrical	351-56,358-59	(D)	(D)	(D)	(D)	(D)	2,396	2,428	2,719	(D)	(D)	(D)
Electrical equipment	36	10,329	10,923	12,681	13,778	14,432	14,980	15,848	16,242	16,929	17,723	17,279
Radio and TV receiving equipment	365	(D)	(D)	(D)	(D)	(D)	133	139	139	84	93	78
Communication equipment	366	4,758	5,839	7,298	8,685	9,397	9,669	10,184	10,296	10,539	10,770	10,444
Electronic components	367	1,573	1,740	2,169	2,831	3,385	(D)	4,286	4,607	4,990	5,432	5,321
Other electrical equipment	361-64,369	(D)	(D)	(D)	(D)	(D)	(D)	1,239	1,200	1,316	1,428	1,436
Transportation equipment	37	(D)	(D)	(D)	(D)	(D)	31,275	34,246	36,338	36,844	36,019	32,091
Motor vehicles and motor vehicles equipment	371	4,806	4,797	5,318	6,057	6,984	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	11,968	14,451	15,406	18,858	22,231	21,050	24,458	25,900	25,638	25,356	21,692
Professional and scientific instruments	38	3,614	3,930	4,266	4,602	5,013	5,103	5,222	5,426	5,743	6,194	6,621
Scientific and mechanical measuring instruments	381-82	(D)	(D)	(D)	(D)	(D)	(D)	(D)	1,734	1,868	2,096	2,150
Optical, surgical, photographic, and other instruments	383-87	(D)	(D)	(D)	(D)	(D)	(D)	(D)	3,692	3,875	4,098	4,471

See explanatory information and SOURCE at end of table.

Table A-3. Total (company, Federal, and other) funds for industrial R&D performance, by industry and size of company: 1981-91

[Dollars in millions]

Page 2 of 2

Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Distribution by industry:												
Other manufacturing industries 1/	27,31,39	(D)	(D)	(D)	(D)	(D)	382	(D)	(D)	(D)	(D)	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	1,906	2,472	3,337	4,905	6,714	7,446	7,844	8,113	8,286	9,274	9,642
Distribution by size of company: [Based on number of employees]												
Fewer than 500 2/		2,305	2,934	4,422	4,402	5,866	7,071	7,163	(S)	7,820	(S)	(S)
500 to 999 3/		N/A	N/A	N/A	1,439	1,648	1,902	1,725	1,656	1,765	1,976	1,947
1,000 to 4,999		3,148	3,864	4,178	5,520	6,240	7,472	7,262	7,598	7,696	7,786	8,056
5,000 to 9,999		2,988	2,751	2,798	3,251	4,022	4,251	4,501	5,236	5,626	6,163	6,593
10,000 to 24,999		6,762	7,943	9,499	11,351	11,109	10,493	12,043	11,473	10,185	11,598	13,361
25,000 or more		36,607	41,156	44,372	48,837	55,354	56,991	59,461	64,677	68,962	68,852	63,503

1/ Until 1984, tobacco products (SIC 21) was included with "Other manufacturing industries."
2/ Data for 1981-83 are for companies with fewer than 1,000 employees.
3/ Until 1984, data were not broken down into this level of detail. See "Fewer than 500," above.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.
N/A = Not available

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-4. Total (company, Federal, and other) funds for industrial R&D performance, by industry, by size of company: 1991

Page 1 of 1

Industry	SIC code	Total	Size of company [Number of employees]					
			Fewer than 500	500 to 999	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
		[Dollars in millions]						
Total		102,246	(S)	1,947	8,056	6,593	13,361	63,503
Food, kindred, and tobacco products	20-21	1,360	(S)	(S)	101	149	203	892
Textiles and apparel	22-23	(D)	(D)	(D)	47	4	79	(D)
Lumber, wood products, and furniture	24-25	160	(S)	(D)	37	43	53	(D)
Paper and allied products	26	715	(S)	12	71	44	333	193
Chemicals and allied products	28	13,183	(D)	(D)	(D)	1,135	6,061	(D)
Industrial chemicals	281-82,286	4,433	(D)	(D)	(D)	(D)	1,382	(D)
Drugs and medicines	283	(D)	97	37	315	(D)	(D)	(D)
Other chemicals	284-85,287-89	(D)	625	(D)	(D)	(D)	(D)	(D)
Petroleum refining and extraction	13,29	2,245	7	4	(D)	57	(D)	(D)
Rubber products	30	(D)	(S)	(S)	150	(D)	(D)	(D)
Stone, clay, and glass products	32	(D)	(D)	(S)	38	84	229	(D)
Primary metals	33	836	(D)	(D)	(D)	178	(D)	(D)
Ferrous metals and products	331-32,3398-99	(D)	(D)	(D)	62	59	(D)	(D)
Nonferrous metals and products	333-36	(D)	(D)	(S)	(D)	120	66	(D)
Fabricated metal products	34	756	(D)	(S)	(D)	(D)	(D)	(D)
Machinery	35	15,089	1,960	360	1,410	(D)	(D)	(D)
Office, computing, and accounting machines	357	(D)	(S)	171	(D)	(D)	(D)	(D)
Other machinery, except electrical	351-56,358-59	(D)	1,273	188	(D)	(D)	459	(D)
Electrical equipment	36	17,279	1,495	(D)	1,297	(D)	2,481	10,921
Radio and TV receiving equipment	365	78	(S)	(D)	(D)	(D)	0	0
Communication equipment	366	10,444	(D)	86	311	(D)	(D)	8,603
Electronic components	367	5,321	865	(D)	655	(D)	(D)	2,190
Other electrical equipment	361-64,369	1,436	(D)	(D)	(D)	(D)	445	129
Transportation equipment	37	32,091	(D)	(D)	(D)	(D)	1,176	(D)
Motor vehicles and motor vehicles equipment	371	(D)	(D)	16	40	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(S)	(D)	(S)	(D)	(D)	0
Aircraft and missiles	372,376	21,692	(D)	(D)	(D)	97	(D)	20,850
Professional and scientific instruments	38	6,621	(D)	(D)	(D)	501	199	(D)
Scientific and mechanical measuring instruments	381-82	2,150	(S)	76	233	(D)	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	4,471	(D)	(D)	(D)	(D)	(D)	3,191
Other manufacturing industries	27,31,39	(D)	50	(S)	(D)	97	103	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9,642	(S)	589	2,349	(D)	(D)	(D)

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

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Table A-5. Total (company, Federal, and other) funds for industrial R&D performance, by industry, size of company, and size of R&D program: 1991

Page 1 of 1

Industry and size of company	SIC code	Total	Size of R&D program				
			Less than $200,000	$200,000 to $999,999	$1 million to $9.999 million	$10 million to $99.999 million	$100 million or more
		[Dollars in millions]					
Total		102,246	(S)	(S)	6,194	14,276	78,047
Distribution by industry:							
Food, kindred, and tobacco products	20,21	1,360	(D)	(S)	133	739	(D)
Textiles and apparel	22,23	(D)	(D)	(S)	65	109	0
Lumber, wood products, and furniture	24,25	160	(S)	(S)	62	80	0
Paper and allied products	26	715	(D)	(S)	78	418	(D)
Chemicals and allied products	28	13,183	(S)	(S)	635	1,816	10,395
Industrial chemicals	281-82,286	4,433	(S)	(S)	91	885	3,424
Drugs and medicines	283	(D)	(D)	(S)	42	333	5,649
Other chemicals	284-85,287-89	(D)	(D)	(S)	502	598	1,322
Petroleum refining and extraction	13,29	2,245	(S)	(S)	26	350	1,862
Rubber products	30	(D)	(S)	(S)	75	230	(D)
Stone, clay, and glass products	32	(D)	(S)	(S)	31	275	(D)
Primary metals	33	836	(D)	(S)	109	440	(D)
Ferrous metals and products	331-32,3398-99	(D)	(D)	(S)	59	162	0
Nonferrous metals and products	333-36	(D)	(S)	(S)	50	278	(D)
Fabricated metal products	34	756	(D)	(S)	143	369	(D)
Machinery	35	15,089	(D)	(S)	1,168	1,835	(D)
Office, computing, and accounting machines	357	(D)	(D)	(S)	(S)	760	9,943
Other machinery, except electrical	351-56,358-59	(D)	(D)	(S)	569	1,075	1,655
Electrical equipment	36	17,279	(S)	(S)	1,189	2,356	13,189
Radio and TV receiving equipment	365	78	(D)	(S)	(S)	(D)	0
Communication equipment	366	10,444	(S)	(S)	244	575	9,478
Electronic components	367	5,321	(D)	(S)	613	1,085	(D)
Other electrical equipment	361-64,369	1,436	(S)	(S)	311	(D)	(D)
Transportation equipment	37	32,091	(S)	(D)	121	756	(D)
Motor vehicles and motor vehicles equipment	371	(D)	(D)	(S)	61	311	9,596
Other transportation equipment	373-75,379	(D)	(S)	(S)	(S)	140	(D)
Aircraft and missiles	372,376	21,692	(D)	(D)	36	305	21,345
Distribution by industry:							
Professional and scientific instruments	38	6,621	(S)	(S)	523	932	4,821
Scientific and mechanical measuring instruments	381-82	2,150	(D)	(D)	340	354	(D)
Optical, surgical, photographic, and other instruments	383-87	4,471	(D)	(D)	183	578	(D)
Other manufacturing industries	27,31,39	(D)	(D)	(S)	101	288	0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9,642	(S)	(S)	1,735	3,285	3,116
Distribution by size of company: [Number of employees]							
Fewer than 500		(S)	(D)	(S)	3,720	943	(D)
500 to 999		1,947	(S)	(D)	558	1,108	(D)
1,000 to 4,999		8,056	(S)	(S)	1,470	5,288	1,166
5,000 to 9,999		6,593	(S)	22	231	2,568	3,771
10,000 to 24,999		13,361	(S)	(S)	148	2,670	10,536
25,000 or more		63,503	(D)	(D)	67	1,699	61,735

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-6. Number of R&D-performing companies, by industry, size of company, and size of R&D program: 1991

Page 1 of 1

Industry and size of company	SIC code	Total	Size of R&D program				
			Less than $200,000	$200,000 to $999,999	$1 million to $9.999 million	$10 million to $99.999 million	$100 million or more
Total		24,389	15,391	6,305	2,091	480	122
Distribution by industry:							
Food, kindred, and tobacco products	20-21	131	35	41	30	23	2
Textiles and apparel	22-23	458	312	121	19	6	0
Lumber, wood products, and furniture	24-25	148	95	29	20	4	0
Paper and allied products	26	321	122	164	22	12	1
Chemicals and allied products	28	2,459	1,508	715	159	49	28
Industrial chemicals	281-82,286	248	103	102	18	17	8
Drugs and medicines	283	436	102	301	10	8	15
Other chemicals	284-85,287-89	1,775	1,303	312	131	24	5
Petroleum refining and extraction	13,29	135	104	6	7	11	7
Rubber products	30	483	390	55	24	12	2
Stone, clay, and glass products	32	151	90	37	13	9	2
Primary metals	33	254	123	87	25	17	2
Ferrous metals and products	331-32,3398-99	123	38	65	14	6	0
Nonferrous metals and products	333-36	131	85	22	11	11	2
Fabricated metal products	34	1,931	1,690	160	70	10	1
Machinery	35	2,787	1,738	530	435	66	18
Office, computing, and accounting machines	357	494	202	8	242	29	13
Other machinery, except electrical	351-56,358-59	2,293	1,536	522	193	37	5
Electrical equipment	36	3,615	2,169	1,018	326	82	20
Radio and TV receiving equipment	365	179	148	22	8	1	0
Communication equipment	366	661	204	346	84	16	11
Electronic components	367	1,289	780	336	128	37	8
Other electrical equipment	361-64,369	1,486	1,037	314	106	28	1
Transportation equipment	37	268	29	156	37	24	22
Motor vehicles and motor vehicles equipment	371	157	7	122	16	8	4
Other transportation equipment	373-75,379	67	21	25	15	5	1
Aircraft and missiles	372,376	44	1	9	6	11	17
Professional and scientific instruments	38	1,863	1,022	631	172	31	7
Scientific and mechanical measuring instruments	381-82	984	641	215	114	13	1
Optical, surgical, photographic, and other instruments	383-87	879	381	416	58	18	6
Other manufacturing industries	27,31,39	395	327	27	32	9	0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	8,990	5,637	2,528	700	115	10
Distribution by size of company: [Number of employees]							
Fewer than 500		22,221	14,997	5,698	1,459	65	2
500 to 999		713	148	338	176	50	1
1,000 to 4,999		966	210	217	357	175	7
5,000 to 9,999		192	12	36	52	76	16
10,000 to 24,999		166	4	11	37	76	38
25,000 or more		131	20	5	10	38	58

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-7. Company and other (except Federal) funds for industrial R&D performance, by industry and size of company: 1981-91

Page 1 of 2

Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
		[Dollars in millions]										
Total		35,428	40,105	44,588	51,404	57,043	59,932	61,403	65,772	70,562	73,980	76,938
Distribution by industry:												
Food, kindred, and tobacco products 1/	20-21	636	777	824	1,081	1,136	1,280	1,204	1,192	1,284	1,308	1,360
Textiles and apparel	22-23	116	136	150	182	218	246	243	210	(S)	242	215
Lumber, wood products, and furniture	24-25	161	159	152	143	147	144	137	156	172	183	160
Paper and allied products	26	566	566	552	594	576	538	604	664	686	730	715
Chemicals and allied products	28	5,205	6,197	6,792	7,736	8,310	8,664	9,445	10,573	11,383	12,277	13,094
Industrial chemicals	281-82,286	2,393	2,810	2,828	3,057	3,281	3,374	3,531	3,763	3,960	4,272	4,350
Drugs and medicines	283	2,064	2,473	2,896	3,310	3,481	3,657	4,095	4,743	5,164	5,366	6,098
Other chemicals	284-85,287-89	747	914	1,068	1,369	1,548	1,633	1,819	2,067	2,259	2,638	2,646
Petroleum refining and extraction	13,29	1,780	2,003	2,074	2,245	2,194	1,971	1,883	1,923	2,050	2,113	2,235
Rubber products	30	598	617	638	671	659	655	596	635	678	730	694
Stone, clay, and glass products	32	411	472	586	705	825	941	985	826	863	894	895
Primary metals	33	702	711	701	683	730	786	711	642	715	801	819
Ferrous metals and products	331-32,3398-99	415	426	396	357	323	336	249	257	254	245	244
Nonferrous metals and products	333-36	287	285	305	326	407	450	462	385	461	556	575
Fabricated metal products	34	545	565	634	773	780	800	633	687	664	644	626
Machinery	35	6,124	7,227	7,911	9,312	10,721	10,701	10,577	11,992	13,478	13,780	14,034
Office, computing, and accounting machines	357	3,847	4,944	5,634	7,011	8,418	8,380	8,193	9,371	10,780	11,073	10,527
Other machinery, except electrical	351-56,358-59	2,277	2,283	2,277	2,301	2,303	2,321	2,384	2,621	2,698	2,707	3,507
Electrical equipment	36	6,409	6,682	8,158	9,037	9,271	9,767	10,449	11,061	11,641	12,131	12,455
Radio and TV receiving equipment	365	358	364	324	362	350	133	139	139	84	93	78
Communication equipment	366	2,975	3,555	4,500	5,147	5,174	5,117	5,455	5,675	5,820	5,932	6,232
Electronic components	367	1,212	1,342	1,810	2,354	2,826	3,357	3,630	4,068	4,458	4,709	4,726
Other electrical equipment	361-64,369	1,864	1,421	1,524	1,174	921	1,160	1,225	1,179	1,279	1,397	1,419
Transportation equipment	37	7,739	8,621	8,991	10,406	12,092	13,567	13,462	14,162	15,083	14,992	15,874
Motor vehicles and motor vehicles equipment	371	4,219	4,321	4,754	5,384	6,164	7,171	7,167	7,769	8,725	8,548	8,998
Other transportation equipment	373-75,379	80	114	227	258	279	330	356	370	353	304	288
Aircraft and missiles	372,376	3,440	4,186	4,010	4,764	5,649	6,066	5,939	6,023	6,005	6,140	6,588
Professional and scientific instruments	38	2,978	3,407	3,816	4,211	4,622	4,752	4,950	5,306	5,630	6,095	6,521
Scientific and mechanical measuring instruments	381-82	1,235	1,363	1,605	1,671	1,598	1,521	1,598	1,710	1,858	2,086	2,143
Optical, surgical, photographic, and other instruments	383-87	1,743	2,044	2,211	2,540	3,026	3,231	3,352	3,596	3,772	4,009	4,378

See explanatory information and SOURCE at end of table.

Table A-7. Company and other (except Federal) funds for industrial R&D performance, by industry and size of company: 1981-91

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Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
		[Dollars in millions]										
Distribution by industry:												
Other manufacturing industries 1/	27,31,39	411	493	525	373	361	380	380	383	400	472	414
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	1,048	1,472	2,084	3,252	4,401	4,740	5,144	5,360	5,620	6,588	6,827
Distribution by size of company: [Number of employees]												
Fewer than 500 2/		1,880	2,411	3,781	3,781	5,127	6,203	6,200	(S)	(S)	(S)	(S)
500 to 999 3/		N/A	N/A	N/A	1,341	1,531	1,765	1,610	1,517	1,660	1,836	1,711
1,000 to 4,999		2,586	3,241	3,438	4,618	5,249	6,243	6,281	6,441	6,646	6,827	7,125
5,000 to 9,999		2,369	2,224	2,080	2,764	3,350	3,455	3,753	4,322	4,815	5,883	6,439
10,000 to 24,999		5,537	6,448	7,228	8,546	8,366	8,489	9,681	9,668	8,948	9,936	11,633
25,000 or more		23,056	25,781	28,061	30,354	33,421	33,778	33,878	37,438	41,860	42,242	42,172

1/ Until 1984, tobacco products (SIC 21) was included with "Other manufacturing industries."
2/ Data for 1981-83 are for companies with fewer than 1,000 employees.
3/ Until 1984, data were not broken down into this level of detail. See "Fewer than 500," above.

NOTE: Company funds include all funds for industrial R&D work performed within company facilities from all sources except the Federal Government. The sources of funds may comprise those from outside organizations such as research institutions, universities and colleges, other nonprofit organizations, other companies, and state governments, as well as companies' own. Company-financed R&D not performed within the company is excluded.

KEY: (S) = Data have been withheld because of imputation of more than 50 percent.
N/A = Not available

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-8. Company and other (except Federal) funds for industrial R&D performance, by industry and size of company: 1991

Page 1 of 1

Industry	SIC code	Total	Size of company					
			Fewer than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
		[Dollars in millions]						
Total		76,938	(S)	1,711	7,125	6,439	11,633	42,172
Food, kindred, and tobacco products	20-21	1,360	(S)	(S)	101	149	203	892
Textiles and apparel	22-23	215	21	(D)	47	4	79	(D)
Lumber, wood products, and furniture	24-25	160	(S)	(D)	37	43	53	(D)
Paper and allied products	26	715	(S)	12	71	44	333	193
Chemicals and allied products	28	13,094	759	137	1,199	1,129	6,019	3,851
Industrial chemicals	281-82,286	4,350	(D)	62	316	589	(D)	(D)
Drugs and medicines	283	6,098	(D)	37	315	314	4,116	(D)
Other chemicals	284-85,287-89	2,646	625	38	568	226	(D)	(D)
Petroleum refining and extraction	13,29	2,235	7	4	77	57	309	1,780
Rubber products	30	694	(S)	(S)	150	168	(D)	(D)
Stone, clay, and glass products	32	895	(D)	(S)	38	84	(D)	(D)
Primary metals	33	819	(S)	(S)	194	178	89	326
Ferrous metals and products	331-32,3398-99	244	(S)	(S)	62	59	(D)	(D)
Nonferrous metals and products	333-36	575	(S)	(S)	132	120	(D)	(D)
Fabricated metal products	34	626	(D)	(S)	111	76	187	(D)
Machinery	35	14,034	(S)	360	1,368	2,112	730	7,523
Office, computing, and accounting machines	357	10,527	(S)	171	626	1,926	(D)	(D)
Other machinery, except electrical	351-56,358-59	3,507	1,255	188	743	186	(D)	(D)
Electrical equipment	36	12,455	1,427	342	1,174	569	(S)	6,846
Radio and TV receiving equipment	365	78	(S)	(D)	(D)	(D)	0	0
Communication equipment	366	6,232	294	(D)	224	(D)	(S)	4,904
Electronic components	367	4,726	814	(S)	(D)	418	(S)	(D)
Other electrical equipment	361-64,369	1,419	(S)	142	318	(D)	445	(D)
Transportation equipment	37	15,874	(S)	(S)	142	(D)	594	(D)
Motor vehicles and motor vehicles equipment	371	8,998	(D)	(S)	40	191	118	(D)
Other transportation equipment	373-75,379	288	(S)	(D)	(S)	(D)	238	0
Aircraft and missiles	372,376	6,588	(D)	(D)	97	93	237	6,120
Professional and scientific instruments	38	6,527	(D)	156	581	(D)	199	4,424
Scientific and mechanical measuring instruments	381-82	2,143	(S)	76	233	(D)	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	4,378	(D)	(S)	348	488	(D)	(D)
Other manufacturing industries	27,31,39	414	50	(D)	131	97	103	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	6,827	(S)	518	1,704	922	393	658

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-9. Company-financed R&D contracted to outside organizations, by industry and size of company: 1991

Page 1 of 1

Industry and size of company	SIC code	Funds [Dollars in millions]
Total		4,319
Distribution by industry:		
Food, kindred, and tobacco products	20-21	44
Textiles and apparel	22-23	(D)
Lumber, wood products, and furniture	24-25	(D)
Paper and allied products	26	12
Chemicals and allied products	28	1,087
Industrial chemicals	281-82,286	95
Drugs and medicines	283	771
Other chemicals	284-85,287-89	221
Petroleum refining and extraction	13,29	35
Rubber products	30	18
Stone, clay, and glass products	32	(D)
Primary metals	33	24
Ferrous metals and products	331-32,3398-99	4
Nonferrous metals and products	333-36	20
Fabricated metal products	34	3
Machinery	35	256
Office, computing, and accounting machines	357	229
Other machinery, except electrical	351-56,358-59	27
Electrical equipment	36	114
Radio and TV receiving equipment	365	0
Communication equipment	366	63
Electronic components	367	38
Other electrical equipment	361-64,369	13
Transportation equipment	37	1,687
Motor vehicles and motor vehicles equipment	371	(D)
Other transportation equipment	373-75,379	(S)
Aircraft and missiles	372,376	(D)
Professional and scientific instruments	38	(D)
Scientific and mechanical measuring instruments	381-82	4
Optical, surgical, photographic, and other instruments	383-87	(D)
Other manufacturing industries	27,31,39	2
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54, 56,60,62-63,72-73,78,806-07,87	742
Distribution by size of company: [Number of employees]		
Fewer than 500		(S)
500 to 999		35
1,000 to 4,999		275
5,000 to 9,999		218
10,000 to 24,999		881
25,000 or more		2,762

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-10. Number of companies contracting R&D performance to outside organizations and total number of R&D-performing companies, by industry and size of company: 1991

Page 1 of 1

Industry	SIC code	Size of company											
		Fewer than 500 employees		500 to 999 employees		1,000 to 4,999 employees		5,000 to 9,999 employees		10,000 to 24,999 employees		25,000 or more employees	
		Total	Outside	Total	Outside	Total	Outside	Total	Outside	Total	Outside	Total	Outside
Total		22,221	207	713	46	966	132	102	61	166	53	131	51
Food, kindred, and tobacco products	20-21	17	0	28	1	42	7	17	5	13	5	14	4
Textiles and apparel	22-23	288	3	109	1	44	2	6	0	9	0	2	0
Lumber, wood products, and furniture	24-25	78	0	29	0	31	2	7	2	3	2	1	0
Paper and allied products	26	256	0	12	0	29	3	10	1	9	2	5	4
Chemicals and allied products	28	2,326	7	31	6	56	22	17	12	22	11	7	3
Industrial chemicals	281-82,286	203	0	10	2	18	7	7	5	7	1	3	1
Drugs and medicines	283	407	3	6	2	7	4	3	3	11	8	2	1
Other chemicals	284-85,287-89	1,716	4	15	2	31	11	7	4	4	2	2	1
Petroleum refining and extraction	13,29	103	0	5	0	11	1	4	0	5	3	7	4
Rubber products	30	307	0	36	0	130	7	5	1	3	1	2	1
Stone, clay, and glass products	32	89	0	27	0	24	3	4	1	5	1	2	2
Primary metals	33	170	2	21	0	43	7	11	4	5	3	4	1
Ferrous metals and products	331-32,3398-99	80	1	9	0	23	4	6	3	2	2	3	1
Nonferrous metals and products	333-36	90	1	12	0	20	3	5	1	3	1	1	0
Fabricated metal products	34	1,799	0	61	1	54	3	7	1	9	3	1	0
Machinery	35	2,558	4	78	10	116	15	20	3	9	2	6	5
Office, computing, and accounting machines	357	436	3	16	2	28	7	9	1	2	2	3	3
Other machinery, except electrical	351-56,358-59	2,122	1	62	8	88	8	11	2	7	0	3	2
Electrical equipment	36	3,376	70	97	8	97	15	11	4	17	1	17	6
Radio and TV receiving equipment	365	172	0	3	0	3	0	1	0	0	0	0	0
Communication equipment	366	614	55	13	1	17	2	2	0	6	0	9	4
Electronic components	367	1,221	13	21	2	34	6	6	-	4	0	3	1
Other electrical equipment	361-64,369	1,369	2	60	5	43	7	2	1	7	1	5	1
Transportation equipment	37	161	0	25	1	35	7	14	5	15	4	18	11
Motor vehicles and motor vehicles equipment	371	103	0	18	0	20	4	8	2	4	1	4	3
Other transportation equipment	373-75,379	53	0	3	0	4	1	2	1	5	3	0	0
Aircraft and missiles	372,376	5	0	4	1	11	2	4	2	6	0	14	8
Professional and scientific instruments	38	1,771	18	36	8	41	7	7	3	3	0	5	1
Scientific and mechanical measuring instruments	381-82	948	8	13	2	18	0	2	0	2	0	1	0
Optical, surgical, photographic, and other instruments	383-87	823	10	23	6	23	7	5	3	1	0	4	1
Other manufacturing industries	27,31,39	312	1	31	0	38	3	7	0	5	0	2	0
Nonmanufacturing industries	10-11,14-17,40-42, 44-51,53-54,56,60, 62-63,72-73,78, 806-07,87	8,610	102	88	10	175	28	45	19	34	15	38	9

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-11. Company-financed R&D performed outside the United States by U.S. domestic companies and their foreign subsidiaries, by selected industry: 1981-91

Industry	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
		[Dollars in millions]										
Total		3,393	3,094	3,269	3,633	3,650	4,624	5,226	6,295	6,814	7,727	8,690
Food, kindred, and tobacco products 1/	20-21	62	64	63	70	75	69	37	27	41	40	63
Chemicals and allied products	28	715	682	729	786	843	1,071	1,243	1,501	1,504	1,990	2,323
Industrial and other chemicals	281-82,284-89	287	319	368	385	444	579	625	781	508	547	701
Drugs and medicines	283	428	363	361	401	399	492	618	720	996	1,443	1,622
Petroleum refining and extraction	13,29	194	133	103	101	47	40	47	58	45	71	97
Stone, clay, and glass products	32	18	10	19	60	(D)	(D)	(D)	(D)	(D)	263	(D)
Primary metals	33	9	9	10	9	(D)	(D)	18	24	26	30	24
Fabricated metal products	34	30	25	23	21	21	26	40	(D)	46	65	(S)
Machinery	35	612	494	577	740	689	951	1,233	1,364	1,515	1,580	1,653
Electrical equipment	36	475	467	482	537	591	(S)	432	669	574	671	620
Radio and TV receiving equipment	365	(T)	(T)	(T)	(D)	(D)	(D)	0	(D)	(D)	(D)	(D)
Communication equipment	366	(T)	(T)	(T)	(D)	(D)	(D)	188	339	271	278	(D)
Electronic components	367	40	38	(T)	92	117	150	204	278	204	266	266
Other electrical equipment	361-64,369	39	43	38	30	24	25	39	(D)	(D)	(D)	71
Transportation equipment	37	884	843	880	907	1,025	(D)	(D)	1,801	(D)	(D)	(D)
Motor vehicles and other transportation equipment	371,373-75,379	(T)	(T)	(T)	(D)	(D)	(D)	(D)	1,469	(D)	(D)	(D)
Aircraft and missiles	372,376	(T)	(T)	(T)	(D)	(D)	182	237	332	614	277	516
Professional and scientific instruments	38	230	237	(T)	263	169	212	317	393	449	563	588
Other manufacturing industries 1/	22-27,30-31,39	156	123	92	131	125	141	138	145	179	187	207
Nonmanufacturing industries	10-11,14-17,40-42, 44-51,53-54,56,60, 62-63,72-73,78, 806-07,87	8	7	10	8	18	27	64	95	108	114	139

1/ Until 1984, tobacco products (SIC 21) was included with "Other manufacturing industries."

NOTE: Data are reported in current U.S. dollars.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.
(T) = Data are not separately available but are included in total.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-12. Federal funds for industrial R&D performance, by industry and size of company: 1981-91

Page 1 of 2

Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
		[Dollars in millions]										
Total		16,382	18,545	20,680	23,396	27,196	27,891	30,752	32,117	31,292	30,626	25,308
Distribution by industry:												
Food, kindred, and tobacco products 1/	20-21	(D)	(D)	(D)	(D)	(D)	(D)	2	(D)	(D)	(D)	0
Textiles and apparel	22-23	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Lumber, wood products, and furniture	24-25	0	0	0	0	0	0	0	(D)	0	0	0
Paper and allied products	26	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	0	0	0
Chemicals and allied products	28	421	407	393	191	230	179	190	199	83	67	89
Industrial chemicals	261-82,286	409	396	386	183	217	178	185	196	79	65	83
Drugs and medicines	283	(D)	(D)	(D)	(D)	(D)	1	(D)	3	(D)	(D)	(D)
Other chemicals	284-85,287-89	(D)	(D)	(D)	(D)	(D)	0	(D)	0	(D)	(D)	(D)
Petroleum refining and extraction	13,29	(D)	(D)	(D)	(D)	(D)	(D)	14	21	(S)	(S)	10
Rubber products	30	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Stone, clay, and glass products	32	(D)	(D)	(D)	(D)	(D)	9	10	(D)	(D)	(D)	(D)
Primary metals	33	176	276	384	(D)	(D)	(D)	19	21	34	(D)	17
Ferrous metals and products	331-32,3398-99	(D)	(D)	(D)	(D)	(D)	(D)	(D)	1	(D)	(D)	(D)
Nonferrous metals and products	333-36	(D)	(D)	(D)	10	9	8	(D)	20	(D)	(D)	(D)
Fabricated metal products	34	80	60	67	69	49	95	150	142	135	134	130
Machinery	35	694	851	1,116	1,192	1,495	(D)	(D)	(D)	1,157	916	1,055
Office, computing, and accounting machines	357	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other machinery, except electrical	351-56,358-59	(D)	(D)	(D)	(D)	(D)	75	44	98	(D)	(D)	(D)
Electrical equipment	36	3,920	4,241	4,523	4,741	5,161	5,213	5,399	5,181	5,288	5,592	4,824
Radio and TV receiving equipment	365	(D)	(D)	(D)	(D)	(D)	0	0	0	0	0	0
Communication equipment	366	1,783	2,284	2,798	3,538	4,223	4,552	4,729	4,621	4,719	4,838	4,212
Electronic components	367	361	398	359	477	559	(D)	656	539	532	723	595
Other electrical equipment	361-64,369	(D)	(D)	(D)	(D)	(D)	(D)	14	21	37	31	17
Transportation equipment	37	(D)	(D)	(D)	(D)	(D)	17,708	20,784	22,176	21,761	21,027	16,217
Motor vehicles and motor vehicles equipment	371	587	476	564	673	820	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	8,528	10,265	11,396	14,094	16,582	14,984	18,519	19,877	19,633	19,216	15,104
Professional and scientific instruments	38	637	523	450	391	391	351	272	120	113	99	100
Scientific and mechanical measuring instruments	381-82	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(S)	(S)	(S)	(S)
Optical, surgical, photographic, and other instruments	383-87	(D)	(D)	(D)	(D)	(D)	(D)	(D)	96	103	89	93

See explanatory information and SOURCE at end of table.

Table A-12. Federal funds for industrial R&D performance, by industry and size of company: 1981-91

Page 2 of 2

Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
		[Dollars in millions]										
Distribution by industry:												
Other manufacturing industries 1/	27,31,39	(D)	(D)	(D)	(D)	(D)	2	(D)	(D)	(D)	(D)	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	858	1,000	1,253	1,653	2,313	2,706	2,700	2,753	2,666	2,686	2,815
Distribution by size of company: [Number of employees]												
Fewer than 500 2/		424	523	641	621	739	868	963	864	987	975	928
500 to 999 3/		N/A	N/A	N/A	98	117	137	115	139	105	(S)	(S)
1,000 to 4,999		562	623	740	902	991	1,229	981	1,157	1,050	959	931
5,000 to 9,999		619	527	718	487	672	796	748	914	811	280	154
10,000 to 24,999		1,225	1,495	2,271	2,805	2,743	2,004	2,362	1,805	1,237	1,662	1,728
25,000 or more		13,551	15,377	16,311	18,483	21,933	23,213	25,583	27,239	27,102	26,610	21,331

1/ Until 1984, tobacco products (SIC 21) was included with "Other manufacturing industries."

2/ Data for 1981-83 are for companies with fewer than 1,000 employees.

3/ Until 1984, data were not broken down into this level of detail. See "Fewer than 500," above.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.
N/A = Not available

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

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Table A-13. Federal funds for industrial R&D performance, by industry and size of company: 1991

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Industry	SIC code	Total	Size of company					
			Fewer than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
		[Dollars in millions]						
Total		25,308	928	(S)	931	154	1,728	21,331
Food, kindred, and tobacco products	20-21	0	0	0	0	0	0	0
Textiles and apparel	22-23	(D)	(D)	0	0	0	0	0
Lumber, wood products, and furniture	24-25	0	0	0	0	0	0	0
Paper and allied products	26	0	0	0	0	0	0	0
Chemicals and allied products	28	89	(D)	(D)	(D)	6	42	(D)
Industrial chemicals	281-82,286	83	0	(D)	(D)	(D)	(D)	(D)
Drugs and medicines	283	(D)	(D)	0	0	(D)	(D)	0
Other chemicals	284-85,287-89	(D)	0	0	(D)	(D)	(D)	0
Petroleum refining and extraction	13,29	10	0	0	(D)	0	(D)	(D)
Rubber products	30	(D)	0	0	0	(D)	0	0
Stone, clay, and glass products	32	(D)	0	0	1	0	(D)	(D)
Primary metals	33	17	(D)	(D)	(D)	0	(D)	(D)
Ferrous metals and products	331-32,3398-99	(D)	(D)	(D)	0	0	0	(D)
Nonferrous metals and products	333-36	(D)	(D)	0	(D)	0	(D)	(D)
Fabricated metal products	34	130	0	0	(D)	(D)	(D)	(D)
Machinery	35	1,055	18	0	43	(D)	(D)	(D)
Office, computing, and accounting machines	357	(D)	0	0	(D)	(D)	0	(D)
Other machinery, except electrical	351-56,358-59	(D)	18	0	(D)	(D)	(D)	(D)
Electrical equipment	36	4,824	67	(D)	123	(D)	383	4,075
Radio and TV receiving equipment	365	0	0	0	0	0	0	0
Communication equipment	366	4,212	(D)	(D)	87	(D)	(D)	8,699
Electronic components	367	595	51	(D)	(D)	(D)	(D)	(D)
Other electrical equipment	361-64,369	17	(D)	(D)	(D)	0	0	(D)
Transportation equipment	37	16,217	(D)	(D)	(D)	16	582	(D)
Motor vehicles and motor vehicles equipment	371	(D)	0	0	0	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	0	0	0	(D)	(D)	0
Aircraft and missiles	372,376	15,104	(D)	(D)	(D)	4	(D)	14,730
Professional and scientific instruments	38	100	(D)	(D)	(D)	(D)	0	(D)
Scientific and mechanical measuring instruments	381-82	(S)	(S)	0	0	0	0	0
Optical, surgical, photographic, and other instruments	383-87	93	(D)	(D)	(D)	(D)	0	(D)
Other manufacturing industries	27,31,39	(D)	0	(D)	(D)	0	0	0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	2,815	824	70	645	(D)	(D)	(D)

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-14. Federal funds for industrial R&D performance, by agency and selected industry in selected years: 1974-91

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Industry	SIC code	1974	1975	1976	1977	1979	1981	1983	1985	1987	1989	1991
		[Dollars in millions]										
All agencies												
Total		8,220	8,605	9,561	10,485	12,518	16,382	20,680	27,196	30,752	31,292	25,308
Chemicals and allied products	28	214	236	266	295	346	421	393	230	193	87	89
Machinery	35	511	509	532	477	335	694	1,116	1,495	(D)	(D)	1,055
Electrical equipment	36	2,307	2,307	2,555	2,648	3,309	3,920	4,684	5,521	5,859	5,222	4,824
Motor vehicles and other transportation equipment	371,373-75,379	335	365	(T)	(T)	(T)	(T)	(T)	820	2,265	2,129	1,114
Aircraft and missiles	372,376	4,003	4,434	4,930	5,486	5,840	8,528	11,103	15,626	17,665	19,634	15,104
Other industries	–	850	754	(T)	(T)	(T)	(T)	(T)	3,436	(D)	(D)	(D)
DOD 1/												
Total		5,919	5,812	6,222	6,950	7,939	10,540	14,571	20,948	22,252	(S)	(S)
Chemicals and allied products	28	39	27	28	32	36	40	48	(S)	(D)	(S)	(S)
Machinery	35	426	405	442	395	541	599	963	1,287	(D)	(D)	748
Electrical equipment	36	1,643	1,570	1,607	1,692	1,920	2,338	3,166	4,078	(S)	3,110	(S)
Motor vehicles and other transportation equipment	371,373-75,379	251	288	337	382	(T)	(T)	(T)	(D)	(D)	(D)	623
Aircraft and missiles	372,376	2,992	3,120	3,408	3,900	4,210	6,121	8,659	13,117	13,084	(S)	(S)
Other industries	–	568	402	400	461	(T)	(T)	(T)	(D)	2,741	1,924	(D)
NASA 1/												
Total		1,095	1,409	1,604	1,697	1,786	2,306	2,150	(S)	2,805	(S)	(S)
Chemicals and allied products	28	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(S)	(D)	0	(S)
Machinery	35	63	62	62	54	74	81	(T)	(D)	(D)	(D)	(D)
Electrical equipment	36	162	186	200	208	252	317	195	96	125	(D)	(S)
Motor vehicles and other transportation equipment	371,373-75,379	25	27	(T)	(T)	(T)	(T)	(T)	(S)	(D)	(D)	16
Aircraft and missiles	372,376	789	1,082	1,267	1,348	1,221	1,785	1,909	(S)	2,528	(S)	(S)
Other industries	–	(1)	(1)	45	44	119	70	(T)	(D)	52	39	(D)
DOE												
Total		2	2	(T)	2	1,575	1,976	1,949	2,901	2,968	3,530	(S)
Chemicals and allied products	28	2	2	2	2	(T)	(T)	(T)	(S)	174	(S)	(S)
Machinery	35	2	2	2	2	(T)	(T)	(T)	(S)	(D)	(S)	(D)
Electrical equipment	36		2	2	2	784	951	950	1,271	1,285	1,888	(S)
Motor vehicles and other transportation equipment	371,373-75,379	2	2	2	2	16	20	28	(S)	(D)	0	0
Aircraft and missiles	372,376	2	2	2	2	253	340	202	441	656	(S)	(S)
Other industries	–	2	2	2	2	287	356	281	575	778	(S)	(D)

1/ For 1974, funds were based on approximately 175 companies leading in Federal R&D funds; 1975-91 funds are based on all companies reporting Federal R&D funds.
2/ Data not tabulated for this agency prior to 1979.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual agencies.
(S) = Data have been withheld because of imputation of more than 50 percent.
(T) = Not separately available but included in total. See general notes.
"–" = For brevity SIC codes are not listed.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-15. Number of R&D performing companies reporting Federal R&D funds, and total number of R&D-performing companies, by industry and size of company: 1991

Page 1 of 1

Industry	SIC code	Size of company											
		Fewer than 500 employees		500 to 999 employees		1,000 to 4,999 employees		5,000 to 9,999 employees		10,000 to 24,999 employees		25,000 or more employees	
		Total	Federal	Total	Federal	Total	Federal	Total	Federal	Total	Federal	Total	Federal
Total		22,221	1,309	713	36	966	50	192	19	166	37	131	49
Food, kindred, and tobacco products	20-21	17	0	28	0	42	0	17	0	13	1	14	0
Textiles and apparel	22-23	288	1	109	0	44	0	6	0	9	0	2	0
Lumber, wood products, and furniture	24-25	78	0	28	0	31	0	7	0	3	0	1	0
Paper and allied products	26	256	0	12	0	29	0	10	0	9	0	5	0
Chemicals and allied products	28	2,326	100	31	1	56	5	17	4	22	7	7	3
Industrial chemicals	281-82,286	203	0	10	1	18	3	[illegible]	2	7	4	3	3
Drugs and medicines	283	407	100	6	0	7	0	3	1	11	2	2	0
Other chemicals	284-85,287-89	1,716	0	15	0	31	2	7	1	4	1	2	0
Petroleum refining and extraction	13,29	103	0	5	0	11	1	4	0	5	2	7	3
Rubber products	30	307	0	36	0	130	0	5	1	3	0	2	0
Stone, clay, and glass products	32	89	0	27	0	24	0	4	0	5	2	2	2
Primary metals	33	170	3	21	1	43	2	11	0	5	2	4	2
Ferrous metals and products	331-32,3398-99	80	1	9	1	23	0	6	0	2	0	3	1
Nonferrous metals and products	333-36	90	2	12	0	20	2	5	0	3	2	1	1
Fabricated metal products	34	1,799	0	61	0	54	1	7	1	9	2	1	1
Machinery	35	2,558	45	78	0	116	7	20	3	9	1	6	3
Office, computing, and accounting machines	357	436	0	16	0	28	3	9	1	2	0	3	2
Other machinery, except electrical	351-56,358-59	2,122	45	62	0	88	4	11	2	7	1	3	[illegible]
Electrical equipment	36	3,376	128	97	18	97	13	11	3	17	4	17	13
Radio and TV receiving equipment	365	172	0	3	0	3	0	1	0	0	0	0	0
Communication equipment	366	614	2	13	3	17	7	2	1	5	3	9	8
Electronic components	367	1,221	124	21	2	34	4	6	2	4	1	3	3
Other electrical equipment	361-64,369	1,369	2	60	13	43	2	2	0	7	0	5	2
Transportation equipment	37	161	1	25	1	35	5	14	5	15	7	15	16
Motor vehicles and motor vehicles equipment	371	103	0	18	0	20	0	8	1	4	1	4	2
Other transportation equipment	373-75,379	53	0	3	0	4	0	2	1	5	2	0	0
Aircraft and missiles	372,376	5	1	4	1	11	5	4	3	6	4	14	14
Professional and scientific instruments	38	1,771	19	36	1	41	2	7	1	3	0	5	2
Scientific and mechanical measuring instruments	381-82	948	18	13	0	18	0	2	0	2	0	1	0
Optical, surgical, photographic, and other instruments	383-87	823	1	23	1	23	2	5	1	1	0	4	2
Other manufacturing industries	27,31,39	312	0	31	2	38	1	7	0	5	0	2	0
Nonmanufacturing industries	10-11,14-17,40-42, 44-51,53-54,56,60 62-63,72-7,78, 806-07,87	8,610	1,012	88	12	175	13	45	1	34	9	38	4

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-16. Industry-administered federally funded R&D centers (FFRDCs)–funds by character of work, full-time-equivalent (FTE) R&D scientists and engineers, and total number of employees: 1989-91

[Dollars in millions]

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Item	1989	1990	1991
Total R&D funds	2,632	2,764	2,722
Basic research	398	499	461
Applied research	475	488	427
Development	1,759	1,777	1,834
Number of FTE R&D scientists and engineers 1/	14,982	15,205	14,890
Total employees 2/	40,690	42,007	43,839

1/ These data were recorded in January of the year following that listed.

2/ These data were recorded in March of the year listed.

NOTE: Industry-administered federally funded research and development centers (FFRDCs) conduct R&D almost exclusively for use by the Federal Government. Data for these FFHDCs administered by industry are included in Federal R&D support under the industry classifications of the administering firms. See technical notes for a listing of industry-administered FFRDC's and their locations.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-17. Number of R&D-performing companies in manufacturing and nonmanufacturing industries, by size of company: 1991

Size of company [Number of employees]	Total	Manufacturing	Nonmanufacturing
Total	24,389	15,404	8,985
Fewer than 500	22,221	13,616	8,605
500 to 999	713	625	88
1,000 to 4,999	966	791	175
5,000 to 9,999	192	147	45
10,000 to 24,999	166	132	34
25,000 or more	131	93	38

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-18. Concentration of total, Federal, company and other R&D funds, and net sales of R&D-performing companies by size of R&D program: 1981-91

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Companies ranked by size of R&D program	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
	Percent of total (company, Federal, and other) R&D funds										
First 4 (1-4)	18	20	19	17	18	19	19	18	19	18	19
Next 4 (5-8)	12	12	11	13	12	11	12	12	13	13	11
Next 12 (9-20)	20	19	17	17	17	14	16	17	16	15	15
Next 20 (21-40)	12	13	13	13	13	13	12	12	12	12	13
Next 60 (41-100)	18	16	17	18	16	15	14	15	15	16	17
Next 100 (101-200)	9	9	9	9	9	10	8	8	8	9	9
Next 200 (201-400)	6	6	6	6	5	8	6	7	6	7	7
	Percent of Federal R&D funds										
First 4 (1-4)	N/A	N/A	N/A	30	29	30	31	32	36	38	34
Next 4 (5-8)	N/A	N/A	N/A	15	15	16	18	18	15	16	18
Next 12 (9-20)	N/A	N/A	N/A	26	27	28	27	28	30	26	28
Next 20 (21-40)	N/A	N/A	N/A	17	16	15	15	15	11	12	12
Next 60 (41-100)	N/A	N/A	N/A	10	7	7	7	6	6	6	7
Next 100 (101-200)	N/A	N/A	N/A	1	2	2	1	3	1	3	1
Next 200 (201-400)	N/A	N/A	N/A	0	0	1	0	0	0	0	0
	Percent of company and other (except Federal) R&D funds										
First 4 (1-4)	N/A	N/A	N/A	22	23	20	20	21	22	21	21
Next 4 (5-8)	N/A	N/A	N/A	8	7	7	7	7	7	7	8
Next 12 (9-20)	N/A	N/A	N/A	12	12	12	12	12	13	12	13
Next 20 (21-40)	N/A	N/A	N/A	12	12	10	11	12	12	13	13
Next 60 (41-100)	N/A	N/A	N/A	18	18	16	16	16	16	17	16
Next 100 (101-200)	N/A	N/A	N/A	11	10	10	10	10	10	10	10
Next 200 (201-400)	N/A	N/A	N/A	7	7	8	8	8	8	8	8
	Percent of net sales										
First 4 (1-4)	N/A	N/A	N/A	7	8	8	7	7	6	8	8
Next 4 (5-8)	N/A	N/A	N/A	4	4	5	5	5	5	4	3
Next 12 (9-20)	N/A	N/A	N/A	5	5	5	5	5	5	5	5
Next 20 (21-40)	N/A	N/A	N/A	8	8	7	7	6	5	5	5
Next 60 (41-100)	N/A	N/A	N/A	12	12	10	11	11	12	12	12
Next 100 (101-200)	N/A	N/A	N/A	13	13	10	8	9	8	9	9
Next 200 (201-400)	N/A	N/A	N/A	14	15	9	12	10	11	12	12

KEY: N/A = Not available

NOTE: Companies were ranked individually for each year; therefore, particular companies composing the size groups may have changed from year to year.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-19. Domestic net sales of R&D-performing companies, by industry and size of company: 1990-91

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Industry	SIC code	Total	Size of company					
			Fewer than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
		[Dollars in millions]						
		1990						
Total		2,655,421	(S)	(S)	343,020	268,684	483,504	1,302,381
Food, kindred, and tobacco products	20-21	245,147	(S)	(S)	(S)	28,699	49,853	132,350
Textiles and apparel	22-23	(S)	(S)	(S)	(S)	(S)	17,437	(D)
Lumber, wood products, and furniture	24-25	24,861	(S)	(S)	7,967	5,412	4,765	(D)
Paper and allied products	26	92,063	(S)	(S)	(S)	11,452	27,000	37,882
Chemicals and allied products	28	220,011	(S)	5,429	34,424	20,633	60,145	84,713
Industrial chemicals	281-82,286	91,504	(S)	2,123	9,045	12,888	22,279	43,745
Drugs and medicines	283	57,404	(S)	776	8,347	(D)	26,327	(D)
Other chemicals	284-85,287-89	71,102	(S)	2,530	17,032	(D)	11,540	(D)
Petroleum refining and extraction	13,29	215,184	(S)	(S)	(S)	7,963	45,757	142,884
Rubber products	30	41,729	(S)	(S)	8,762	6,215	8,080	(D)
Stone, clay, and glass products	32	36,908	(S)	(S)	(S)	(D)	13,401	(D)
Primary metals	33	81,247	(S)	(S)	15,373	13,373	15,524	31,772
Ferrous metals and products	331-32,3398-99	44,601	(S)	(S)	(S)	5,787	(D)	(D)
Nonferrous metals and products	333-36	36,646	(S)	(S)	8,471	7,586	(D)	(D)
Fabricated metal products	34	(S)	(S)	(S)	(S)	6,864	12,453	(D)
Machinery	35	165,362	(S)	8,474	32,382	27,038	17,669	56,204
Office, computing, and accounting machines	357	72,383	(S)	2,551	6,352	14,699	4,793	40,550
Other machinery, except electrical	351-56,358-59	92,980	(S)	(S)	26,030	12,339	12,876	15,654
Electrical equipment	36	258,447	(S)	7,839	25,510	12,622	41,026	146,023
Radio and TV receiving equipment	365	2,957	(S)	(D)	(S)	(D)	0	0
Communication equipment	366	139,470	(D)	1,222	4,269	(D)	18,903	108,898
Electronic components	367	55,385	(D)	(D)	8,617	7,343	7,671	19,630
Other electrical equipment	361-64,369	60,635	(S)	4,585	11,838	(S)	14,452	17,495
Transportation equipment	37	411,587	(D)	(S)	12,906	(D)	34,986	334,464
Motor vehicles and motor vehicles equipment	371	217,513	(D)	(D)	(S)	12,923	13,247	176,833
Other transportation equipment	373-75,379	16,926	(S)	(D)	2,025	(D)	10,759	0
Aircraft and missiles	372,376	177,148	125	(S)	2,797	5,019	10,980	157,631
Professional and scientific instruments	38	79,826	(S)	(S)	10,312	5,291	3,807	46,918
Scientific and mechanical measuring instruments	381-82	22,126	(S)	865	3,763	2,355	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	57,700	(S)	(S)	6,549	2,936	(D)	(D)
Other manufacturing industries	27,31,39	41,367	(D)	(S)	13,499	8,037	10,151	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	(S)	(S)	(S)	(S)	91,651	121,452	244,579

See explanatory information and SOURCE at end of table.

Table A-19. Domestic net sales of R&D-performing companies, by industry and size of company: 1990-91

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Industry	SIC code	Total	Size of company					
			Fewer than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
		[Dollars in millions]						
		1991						
Total		2,606,922	(S)	(S)	336,739	265,893	479,936	1,271,630
Food, kindred, and tobacco products	20-21	249,176	(S)	(S)	(S)	30,147	47,769	136,460
Textiles and apparel	22-23	(S)	(S)	(D)	8,717	(S)	13,062	(D)
Lumber, wood products, and furniture	24-25	23,459	(S)	(D)	8,071	4,501	4,479	(D)
Paper and allied products	26	89,753	(S)	(S)	(S)	10,821	28,177	35,857
Chemicals and allied products	28	229,413	(S)	5,102	30,662	26,838	79,238	72,417
Industrial chemicals	281-82,286	90,235	(S)	2,145	9,415	12,506	28,052	36,758
Drugs and medicines	283	62,791	(D)	598	4,265	3,213	39,858	(D)
Other chemicals	284-85,287-89	76,386	(D)	2,359	16,981	11,119	11,328	(D)
Petroleum refining and extraction	13,29	201,489	(S)	(S)	(S)	7,395	41,211	135,708
Rubber products	30	38,532	(S)	(S)	9,895	4,171	(D)	(D)
Stone, clay, and glass products	32	34,976	(S)	(D)	(S)	2,469	11,965	(D)
Primary metals	33	75,138	(S)	(S)	14,570	12,036	14,431	29,112
Ferrous metals and products	331-32,3398-99	41,113	(S)	(S)	(S)	5,473	(D)	(D)
Nonferrous metals and products	333-36	34,025	(S)	(S)	8,116	6,563	(D)	(D)
Fabricated metal products	34	(S)	(S)	(D)	(S)	5,067	16,130	(D)
Machinery	35	152,840	(S)	7,263	35,426	21,380	16,106	49,494
Office, computing, and accounting machines	357	65,357	(D)	1,708	8,716	13,188	(D)	35,515
Other machinery, except electrical	351-56,358-59	87,483	(D)	5,556	26,710	8,192	(D)	13,979
Electrical equipment	36	262,266	(S)	10,131	24,692	10,856	45,204	148,458
Radio and TV receiving equipment	365	(S)	(D)	(D)	(S)	(D)	0	0
Communication equipment	366	144,745	5,877	(D)	4,121	(D)	21,943	110,669
Electronic components	367	54,137	(S)	1,848	9,103	6,676	7,912	20,159
Other electrical equipment	361-64,369	60,168	(D)	7,158	10,619	(D)	15,348	17,630
Transportation equipment	37	391,644	(S)	(D)	(S)	(D)	29,603	317,723
Motor vehicles and motor vehicles equipment	371	201,975	(S)	(S)	(S)	15,272	8,523	164,481
Other transportation equipment	373-75,379	16,658	(S)	(D)	(S)	(D)	10,125	0
Aircraft and missiles	372,376	173,010	(S)	(S)	(S)	5,325	10,954	153,242
Professional and scientific instruments	38	83,606	(S)	(S)	11,564	5,241	3,352	49,653
Scientific and mechanical measuring instruments	381-82	22,651	(S)	986	3,968	(D)	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	60,955	(S)	(S)	7,596	(D)	(D)	(D)
Other manufacturing industries	27,31,39	40,633	(S)	(D)	13,530	5,994	7,844	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	615,873	(S)	(S)	(S)	92,962	115,066	249,411

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-20. Total (company, Federal, and other) R&D funds as a percent of net sales in R&D-performing manufacturing companies, by industry and size of company: 1981-91

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Industry an˝ size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total		3.1	3.8	3.9	3.9	4.4	4.7	4.6	4.7	4.6	4.7	4.7
Distribution by industry:												
Food, kindred, and tobacco products 1/	20-21	(D)	(D)	(D)	(D)	(D)	(D)	0.6	(D)	(D)	(D)	0.5
Textiles and apparel	22-23	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Lumber, wood products, and furniture	24-25	0.8	0.8	0.8	0.7	0.8	0.6	0.6	(D)	0.7	0.7	0.7
Paper and allied products	26	(D)	1.1	(D)	(D)	(D)	(D)	(D)	(D)	0.7	0.8	0.8
Chemicals and allied products	28	3.6	4.3	4.4	4.7	5.0	5.2	5.3	5.4	5.4	5.6	5.7
Industrial chemicals	281-82,286	3.2	4.0	3.9	4.0	4.4	4.6	4.7	4.5	4.4	4.7	4.9
Drugs and medicines	283	(D)	(D)	(D)	(D)	(D)	8.5	(D)	9.0	(D)	(D)	(D)
Other chemicals	284-85,287-89	(D)	(D)	(D)	(D)	(D)	3.3	(D)	3.5	(D)	(D)	(D)
Petroleum refining and extraction	13,29	(D)	(D)	(D)	(D)	(D)	(D)	1.0	1.0	1.0	1.0	1.1
Rubber products	30	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Stone, clay, and glass products	32	(D)	(D)	(D)	(D)	(D)	2.5	2.6	(D)	(D)	(D)	(D)
Primary metals	33	0.9	1.1	1.3	(D)	(D)	(D)	0.9	0.8	0.9	(D)	1.1
Ferrous metals and products	331-32,3398-99	(D)	(D)	(D)	(D)	(D)	(D)	(D)	0.6	(D)	(D)	(D)
Nonferrous metals and products	333-36	(D)	(D)	(D)	1.2	1.4	1.5	(D)	1.1	(D)	(D)	(D)
Fabricated metal products	34	1.4	1.3	1.4	1.5	1.5	1.5	1.5	1.3	1.2	1.2	1.2
Machinery	35	4.9	5.6	6.2	6.4	7.6	(D)	(D)	(D)	8.7	8.9	9.9
Office, computing, and accounting machines	357	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other machinery, except electrical	351-56,358-59	(D)	(D)	(D)	(D)	(D)	3.0	3.0	3.2	(D)	(D)	(D)
Electrical equipment	36	6.8	7.2	7.9	6.8	7.6	7.9	8.2	7.8	7.1	6.9	6.6
Radio and TV receiving equipment	365	(D)	(D)	(D)	(D)	(D)	3.6	3.2	3.0	2.8	3.1	2.4
Communication equipment	366	9.6	11.0	11.5	9.8	10.1	9.9	10.2	9.8	8.7	7.7	7.2
Electronic components	367	7.4	6.8	7.7	7.8	9.6	(D)	10.0	9.5	(D)	9.8	9.8
Other electrical equipment	361-64,369	(D)	(D)	(D)	(D)	(D)	(D)	2.7	2.4	(D)	2.4	2.4
Transportation equipment	37	N/A	N/A	N/A	(D)	(D)	8.3	8.7	8.9	9.0	8.8	8.2
Motor vehicles and motor vehicles equipment	371	4.5	4.5	4.0	3.4	3.8	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	16.0	17.1	15.2	15.4	14.9	13.4	14.7	15.6	15.3	14.3	12.5
Professional and scientific instruments	38	8.1	8.4	8.6	8.3	8.9	8.8	7.9	7.5	7.5	7.8	7.9
Scientific and mechanical measuring instruments	381-82	(D)	(D)	(D)	(D)	(D)	(D)	(D)	8.5	8.6	9.5	9.5
Optical, surgical, photographic, and other instruments	383-87	(D)	(D)	(D)	(D)	(D)	(D)	(D)	7.1	7.1	7.1	7.3
Other manufacturing industries 1/	27,31,39	(D)	(D)	(D)	(D)	(D)	1.2	(D)	(D)	(D)	(D)	(D)

See explanatory information and SOURCE at end of table.

Table A-20. Total (company, Federal, and other) R&D funds as a percent of net sales in R&D-performing manufacturing companies, by industry and size of company: 1981-91

Page 2 of 2

Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Distribution by size of company: [Number of employees]												
Fewer than 500 2/		1.5	1.8	2.5	2.9	3.6	4.1	3.9	3.6	3.7	3.7	4.2
500 to 999 3/		N/A	N/A	N/A	2.3	2.4	2.4	2.3	2.2	1.7	2.0	2.2
1,000 to 4,999		1.7	1.9	2.0	2.2	2.6	2.5	2.6	2.5	2.1	2.3	2.4
5,000 to 9,999		2.1	1.7	1.7	1.8	1.9	2.3	2.3	2.3	2.6	3.1	3.3
10,000 to 24,999		1.9	2.4	2.8	3.1	3.1	3.2	3.1	3.1	2.7	2.9	3.4
25,000 or more		4.6	5.4	5.5	5.3	6.2	6.5	6.6	6.6	6.4	6.4	6.1

1/ Until 1984, tobacco products (SIC 21) was included with "Other manufacturing industries."
2/ Data for 1981-83 are for companies with fewer than 1,000 employees.
3/ Until 1984, data were not broken down into this level of detail. See "Fewer than 500," above.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
N/A = Not available

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-21. Company and other (except Federal) R&D funds as a percent of net sales in R&D-performing manufacturing companies, by industry and size of company: 1981-91

Page 1 of 1

Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total		2.2	2.6	2.6	2.6	3.0	3.2	3.1	3.1	3.2	3.3	3.5
Distribution by industry:												
Food, kindred, and tobacco products 1/	20-21	0.4	0.4	0.4	0.4	0.6	0.6	0.6	0.5	0.5	0.5	0.5
Textiles and apparel	22-23	0.4	0.5	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4
Lumber, wood products, and furniture	24-25	0.8	0.8	0.8	0.7	0.8	0.6	0.6	0.7	0.7	0.7	0.7
Paper and allied products	26	1.0	1.1	0.9	0.8	0.8	0.7	0.6	0.7	0.7	0.8	0.8
Chemicals and allied products	28	3.4	4.0	4.2	4.6	4.9	5.1	5.2	5.3	5.3	5.6	5.7
Industrial chemicals	281-82,286	2.8	3.5	3.4	3.8	4.2	4.4	4.4	4.3	4.3	4.7	4.8
Drugs and medicines	283	6.3	7.0	7.7	8.2	8.0	8.4	8.7	9.0	9.1	9.3	9.7
Other chemicals	284-85,287-89	2.1	2.3	2.5	2.9	3.1	3.3	3.3	3.5	3.4	3.7	3.5
Petroleum refining and extraction	13,29	0.6	0.8	0.7	0.7	0.9	1.1	1.0	1.0	1.0	1.0	1.1
Rubber products	30	1.9	1.7	1.7	1.9	1.8	1.7	1.6	1.6	1.7	1.7	1.8
Stone, clay, and glass products	32	1.4	1.7	1.9	1.9	2.3	2.4	2.5	2.2	2.3	2.4	2.6
Primary metals	33	0.7	0.8	0.8	0.9	0.9	1.0	0.9	0.8	0.9	1.0	1.1
Ferrous metals and products	331-32,3398-99	0.6	0.6	0.6	0.6	0.5	0.7	0.6	0.6	0.6	0.5	0.6
Nonferrous metals and products	333-36	1.0	1.3	1.2	1.2	1.4	1.5	1.3	1.1	1.2	1.5	1.7
Fabricated metal products	34	1.2	1.2	1.3	1.4	1.4	1.4	1.2	1.0	1.0	1.0	1.0
Machinery	35	4.4	5.0	5.4	5.8	6.7	7.3	7.1	7.2	8.0	8.3	9.2
Office, computing, and accounting machines	357	9.7	10.4	10.0	10.5	12.4	12.4	12.3	11.5	13.5	15.3	16.1
Other machinery, except electrical	351-56,358-59	2.3	2.4	2.4	2.5	2.6	2.9	3.0	3.1	3.0	2.9	4.0
Electrical equipment	36	4.2	4.4	5.0	4.5	4.8	5.1	5.4	5.3	4.9	4.7	4.7
Radio and TV receiving equipment	365	2.6	3.3	2.9	3.7	4.3	3.6	3.2	3.0	2.8	3.1	(S)
Communication equipment	366	6.0	6.7	7.2	5.1	5.4	5.2	5.5	5.4	5.3	4.3	4.3
Electronic components	367	5.7	5.2	6.6	6.6	8.2	9.2	8.5	8.4	8.0	8.5	8.7
Other electrical equipment	361-64,369	2.8	2.3	2.6	2.2	2.0	2.2	2.6	2.4	2.0	2.3	2.4
Transportation equipment	37	N/A	N/A	N/A	3.3	3.4	3.6	3.4	3.5	3.7	3.6	4.1
Motor vehicles and motor vehicles equipment	371	3.9	4.0	3.5	3.0	3.1	3.3	3.4	3.4	3.8	3.9	4.5
Other transportation equipment	373-75,379	0.3	0.7	1.7	2.0	2.3	2.7	2.5	2.5	2.3	1.8	1.7
Aircraft and missiles	372,376	4.6	5.1	4.1	4.0	3.9	4.0	3.6	3.6	3.6	3.5	3.8
Professional and scientific instruments	38	6.7	7.3	7.7	7.6	8.3	8.2	7.5	7.3	7.3	7.6	7.8
Scientific and mechanical measuring instruments	381-82	6.9	7.6	8.8	8.3	8.4	8.4	8.1	8.4	8.5	9.4	9.5
Optical, surgical, photographic, and other instruments	383-87	6.6	7.1	7.1	7.3	8.1	8.0	7.2	6.9	6.9	6.9	7.2
Other manufacturing industries 1/	27,31,39	0.4	0.8	1.0	1.1	1.0	1.2	1.1	1.1	1.0	1.1	1.0
Distribution by size of company: [Number of employees]												
Fewer than 500 2/		1.4	1.6	2.2	2.8	3.4	4.0	3.8	3.6	3.6	3.6	4.1
500 to 999 3/		N/A	N/A	N/A	2.2	2.2	2.2	2.2	2.1	1.6	1.8	1.9
1,000 to 4,999		1.5	1.7	2.0	2.0	2.4	2.4	2.4	2.1	2.0	2.1	2.3
5,000 to 9,999		1.7	1.5	1.3	1.6	1.8	2.0	2.0	2.3	2.5	3.0	3.2
10,000 to 24,999		1.6	2.0	2.3	2.5	2.5	2.6	2.5	2.6	2.4	2.6	3.1
25,000 or more		2.7	3.3	3.4	3.2	3.5	3.7	3.8	3.8	3.7	3.9	4.1

1/ Until 1984, tobacco products (SIC 21) was included with "Other manufacturing industries."
2/ Data for 1981-83 are for companies with fewer than 1,000 employees.
3/ Until 1984, data were not broken down into this level of detail. See "Fewer than 500," above.

KEY: (S) = Data have been withheld because of imputation of more than 50 percent.
N/A = Not available

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-22. Total (company, Federal, and other) R&D funds as a percent of net sales in R&D-performing manufacturing companies, by industry and ranked by size of R&D program: 1991

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Industry	SIC code	Total R&D funds as a percent of net sales [Percent]			Total R&D funds [Dollars in millions]		
		First 4 companies	Next 4 companies	Next 12 companies	First 4 companies	Next 4 companies	Next 12 companies
Total		9.2	12.2	11.7	19,710	10,842	15,150
Food, kindred, and tobacco products	20-21	0.9	1.0	(S)	636	223	272
Textiles and apparel	22-23	(S)	0.4	0.5	84	43	41
Lumber, wood products, and furniture	24-25	1.2	0.8	0.9	80	28	30
Paper and allied products	26	1.3	2.0	0.4	347	134	125
Chemicals and allied products	28	7.0	7.6	8.8	3,123	2,307	3,728
Industrial chemicals	281-82,286	6.1	4.2	4.2	2,761	683	798
Drugs and medicines	283	11.5	11.5	8.3	2,428	1,511	2,003
Other chemicals	284-85,287-89	4.8	2.0	3.1	1,191	312	304
Petroleum refining and extraction	13,29	1.9	0.8	0.5	1,422	528	273
Rubber products	30	3.8	2.1	1.9	440	63	108
Stone, clay, and glass products	32	4.8	1.6	1.4	731	112	64
Primary metals	33	1.4	1.2	1.2	388	131	186
Ferrous metals and products	331-32,3398-99	(D)	0.9	0.9	130	49	41
Nonferrous metals and products	333-36	3.0	5.3	0.7	381	91	98
Fabricated metal products	34	(S)	1.4	1.1	328	121	80
Machinery	35	23.7	11.1	9.4	8,427	1,543	1,825
Office, computing, and accounting machines	357	21.1	17.5	10.1	8,227	1,042	1,077
Other machinery, except electrical	351-56,358-59	11.3	8.1	4.1	1,544	320	494
Electrical equipment	36	8.9	16.4	8.6	7,786	2,533	2,870
Radio and TV receiving equipment	365	(D)	(S)	(S)	54	(S)	(S)
Communication equipment	366	8.9	12.1	2.6	7,396	1,591	963
Electronic components	367	12.3	16.2	10.9	2,760	672	745
Other electrical equipment	361-64,369	5.0	1.7	1.6	476	157	205
Transportation equipment	37	9.5	11.7	8.2	15,892	7,928	7,049
Motor vehicles and motor vehicles equipment	371	5.9	(S)	0.9	9,596	222	134
Other transportation equipment	373-75,379	3.3	(D)	(S)	321	29	(S)
Aircraft and missiles	372,376	14.0	17.8	8.6	11,862	5,773	3,851
Professional and scientific instruments	38	9.9	6.5	8.2	4,243	675	560
Scientific and mechanical measuring instruments	381-82	(D)	6.5	5.2	(D)	88	132
Optical, surgical, photographic, and other instruments	383-87	8.0	11.9	6.8	3,191	478	368
Other manufacturing industries	27,31,39	3.3	1.8	0.6	193	84	74

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

NOTE: Rankings were based on total (company, Federal, and other) R&D funds.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-23. Company and other (except Federal) R&D funds as a percent of net sales in R&D-performing manufacturing companies, by industry and ranked by size of company-financed R&D program: 1991

Page 1 of 1

Industry	SIC code	Company and other R&D funds as a percent of net sales [Percent]			Company and other R&D funds [Dollars in millions]		
		First 4 companies	Next 4 companies	Next 12 companies	First 4 companies	Next 4 companies	Next 12 companies
Total		7.3	10.2	6.5	15,940	6,060	9,842
Food, kindred, and tobacco products	20-21	0.9	1.0	(S)	636	223	272
Textiles and apparel	22-23	(S)	0.4	0.5	(S)	43	40
Lumber, wood products, and furniture	24-25	1.2	0.8	0.9	80	28	30
Paper and allied products	26	1.3	2.0	0.4	347	134	125
Chemicals and allied products	28	7.0	7.6	8.8	3,103	2,307	3,725
Industrial chemicals	281-82,286	6.1	4.2	4.0	2,741	658	758
Drugs and medicines	283	11.5	11.5	8.3	2,428	1,510	2,003
Other chemicals	284-85,287-89	4.8	2.0	3.1	1,189	311	304
Petroleum refining and extraction	13,29	1.9	0.8	0.5	1,415	528	271
Rubber products	30	3.8	2.1	2.0	440	63	100
Stone, clay, and glass products	32	4.6	1.6	1.4	693	111	64
Primary metals	33	1.5	1.2	1.0	386	131	178
Ferrous metals and products	331-32,3398-99	(D)	0.9	0.9	130	49	41
Nonferrous metals and products	333-36	3.0	(S)	0.8	379	(S)	85
Fabricated metal products	34	(S)	1.1	1.0	237	95	70
Machinery	35	21.2	11.0	9.2	7,554	1,529	1,787
Office, computing, and accounting machines	357	18.8	17.5	9.9	7,354	1,042	1,053
Other machinery, except electrical	351-56,358-59	11.1	5.8	4.3	1,517	296	437
Electrical equipment	36	(D)	6.1	3.5	5,636	1,335	1,879
Radio and TV receiving equipment	365	(S)	(S)	(S)	(S)	(S)	(S)
Communication equipment	366	5.9	3.1	1.7	4,481	721	613
Electronic components	367	14.7	5.7	10.2	2,426	603	634
Other electrical equipment	361-64,369	5.0	1.7	1.6	473	157	204
Transportation equipment	37	5.4	4.5	2.5	10,894	2,651	1,551
Motor vehicles and motor vehicles equipment	371	5.2	(S)	0.8	8,649	(S)	113
Other transportation equipment	373-75,379	2.5	(D)	(S)	237	20	(S)
Aircraft and missiles	372,376	5.1	3.1	2.2	4,502	1,218	722
Professional and scientific instruments	38	9.7	6.5	8.2	4,161	674	560
Scientific and mechanical measuring instruments	381-82	(D)	6.5	5.2	(D)	88	132
Optical, surgical, photographic, and other instruments	383-87	7.8	11.9	6.8	3,109	478	367
Other manufacturing industries	27,31,39	3.3	1.8	0.6	193	84	74

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

NOTE: Rankings were based on company and other (except Federal) R&D funds.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-24. Federal R&D funds as a percent of net sales in R&D-performing manufacturing companies, by industry and ranked by size of Federal R&D program: 1991

Page 1 of 1

Industry	SIC code	Federal R&D funds as a percent of net sales [Percent]			Federal R&D funds [Dollars in millions]		
		First 4 companies	Next 4 companies	Next 12 companies	First 4 companies	Next 4 companies	Next 12 companies
Total		14.1	4.2	3.5	8,714	4,483	6,509
Food, kindred, and tobacco products	20-21	0.0	0.0	0.0	0	0	0
Textiles and apparel	22-23	(D)	0.0	0.0	(D)	0	0
Lumber, wood products, and furniture	24-25	0.0	0.0	0.0	0	0	0
Paper and allied products	26	0.0	0.0	0.0	0	0	0
Chemicals and allied products	28	(D)	0.1	1/	70	11	8
Industrial chemicals	281-82,286	(D)	0.1	1/	70	11	3
Drugs and medicines	283	1/	0.0	0.0	1	0	0
Other chemicals	284-85,287-89	(D)	0.0	0.0	(D)	0	0
Petroleum refining and extraction	13,29	1/	(D)	0.0	10	(D)	0
Rubber products	30	(D)	0.0	0.0	(D)	0	0
Stone, clay, and glass products	32	(D)	0.0	0.0	(D)	0	0
Primary metals	33	(D)	(S)	0.0	(D)	(S)	(D)
Ferrous metals and products	331-32,3398-99	(D)	0.0	0.0	(D)	0	0
Nonferrous metals and products	333-36	(D)	(D)	0.0	(D)	(D)	0
Fabricated metal products	34	2.2	(D)	0.0	119	(D)	0
Machinery	35	(D)	(S)	0.8	(D)	(S)	18
Office, computing, and accounting machines	357	(D)	(D)	0.0	(D)	(D)	0
Other machinery, except electrical	351-56,358-59	1.1	1.4	(S)	116	19	(S)
Electrical equipment	36	4.0	4.8	3.2	3,239	881	601
Radio and TV receiving equipment	365	0.0	0.0	0.0	0	0	0
Communication equipment	366	4.0	5.8	3.4	3,239	765	207
Electronic components	367	2.4	1.3	0.6	490	49	8
Other electrical equipment	361-64,369	(S)	(D)	0.0	(S)	1	0
Transportation equipment	37	14.1	2.8	6.1	8,714	3,790	3,635
Motor vehicles and motor vehicles equipment	371	(D)	0.0	0.0	(D)	0	0
Other transportation equipment	373-75,379	(D)	0.0	0.0	(D)	0	0
Aircraft and missiles	372,376	14.1	6.7	6.1	8,714	3,683	2,693
Professional and scientific instruments	38	(D)	0.4	(S)	(D)	7	(S)
Scientific and mechanical measuring instruments	381-82	(D)	0.0	0.0	(D)	0	0
Optical, surgical, photographic, and other instruments	383-87	(D)	(S)	0.0	(D)	(S)	0
Other manufacturing industries	27,31,39	(D)	0.0	0.0	(D)	0	0

1/ Less than 0.05 percent

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

NOTE: Rankings were based upon Federal R&D funds.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-25. Total (company, Federal, and other) funds for performance of basic research, applied research, and development, in current and in constant dollars: 1953-91

[Dollars in millions]

Page 1 of 1

Year	Total		Basic research		Applied research		Development performance	
	Current dollars	Constant dollars	Current dollars	Constant dollars	Current dollars	Constant dollars	Current dollars	Constant dollars
1953 1/	3,630	16,500	151	686	726	3,300	2,753	12,514
1954 1/	4,070	18,333	166	748	814	3,667	3,090	13,919
1955 1/	4,640	20,262	189	825	928	4,052	3,523	15,384
1956	6,605	27,987	253	1,072	1,268	5,373	5,084	21,542
1957	7,731	31,684	271	1,111	1,670	6,844	5,790	23,730
1958	8,389	33,691	295	1,185	1,911	7,675	6,183	24,831
1959	9,618	37,570	320	1,250	1,991	7,777	7,307	28,543
1960	10,509	40,419	376	1,446	2,029	7,804	8,104	31,169
1961	10,908	41,475	395	1,502	1,977	7,517	8,536	32,456
1962	11,464	42,617	488	1,814	2,449	9,104	8,527	31,699
1963	12,630	46,434	522	1,919	2,457	9,033	9,651	35,482
1964	13,512	48,780	549	1,982	2,600	9,386	10,363	37,412
1965	14,185	49,947	592	2,085	2,658	9,359	10,935	38,504
1966	15,548	52,884	624	2,122	2,843	9,670	12,081	41,092
1967	16,385	54,076	629	2,076	2,915	9,620	12,841	42,380
1968	17,429	54,808	642	2,019	3,124	9,824	13,663	42,965
1969	18,308	54,814	618	1,850	3,287	9,841	14,403	43,123
1970	18,067	51,327	602	1,710	3,427	9,736	14,038	39,881
1971	18,320	49,380	590	1,590	3,415	9,205	14,315	38,585
1972	19,552	50,392	593	1,528	3,514	9,057	15,445	39,807
1973	21,249	51,450	631	1,528	3,825	9,262	16,793	40,661
1974	22,887	50,973	699	1,557	4,288	9,550	17,900	39,866
1975	24,187	49,161	730	1,484	4,570	9,289	18,887	38,389
1976	26,997	51,620	819	1,566	5,112	9,774	21,066	40,279
1977	29,825	53,354	911	1,630	5,636	10,082	23,278	41,642
1978 1/	33,304	55,231	1,035	1,716	6,300	10,448	25,969	43,066
1979	38,226	58,271	1,158	1,765	7,225	11,014	29,843	45,492
1980 1/	44,505	62,071	1,325	1,848	8,450	11,785	34,730	48,438
1981	51,810	65,665	1,614	2,046	10,699	13,560	39,497	50,060
1982 1/	58,650	69,988	1,904	2,272	12,323	14,705	44,423	53,011
1983	65,268	74,849	2,223	2,549	13,927	15,971	49,118	56,328
1984	74,800	82,198	2,608	2,866	15,765	17,324	56,427	62,008
1985	84,239	89,236	2,862	3,032	18,255	19,338	63,122	66,867
1986	87,823	90,633	4,047	4,176	19,759	20,391	64,017	66,065
1987	92,155	92,155	4,324	4,324	19,813	19,813	68,018	68,018
1988	97,889	94,215	4,243	4,084	20,757	19,978	72,889	70,153
1989	101,854	93,875	4,646	4,282	22,388	20,634	74,820	68,959
1990	104,606	92,408	4,909	4,337	23,628	20,873	76,069	67,199
1991	102,246	86,796	4,372	3,711	24,084	20,445	73,789	62,639

1/ Character-of-work estimates were made by the National Science Foundation. See National Science Foundation, National Pattern of R&D Resources: 1990, NSF 90-316.

NOTES: The character-of-work estimation procedure was revised for 1986 and later years; hence, these data are not directly comparable with data for 1985 and earlier years. See technical notes for a more comprehensive discussion of this change.

1987 gross domestic product implicit price deflators were used to convert current dollars to constant dollars.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-26. Funds for performance of basic research, applied research, and development, by industry and source of funds: 1989

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Industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
		[Dollars in millions]											
Total		101,854	31,292	70,562	4,646	1,225	3,421	22,388	4,965	17,423	74,821	25,102	49,718
Food, kindred, and tobacco products	20-21	(D)	(D)	1,284	(S)	0	(S)	(D)	(D)	451	(D)	(D)	752
Textiles and apparel	22-23	(D)	(D)	(S)	(D)	0	(D)	24	0	24	166	(D)	(D)
Lumber, wood products, and furniture	24-25	172	0	172	(D)	0	(D)	(D)	0	(D)	83	0	83
Paper and allied products	26	686	0	686	45	0	45	203	0	203	439	0	439
Chemicals and allied products	28	11,466	83	11,383	881	14	867	4,527	12	4,515	6,058	57	6,001
Industrial chemicals	281-82,286	4,039	79	3,960	337	14	333	(D)	(D)	1,531	(D)	(D)	2,106
Drugs and medicines	283	(D)	(D)	5,164	(S)	0	(S)	(D)	(D)	2,120	(D)	(D)	2,559
Other chemicals	284-85,287-89	(D)	(D)	2,259	60	0	(S)	(D)	(D)	864	(D)	(D)	1,336
Petroleum refining and extraction	13,29	2,066	(S)	2,050	(D)	(D)	104	(D)	(D)	974	984	13	972
Rubber products	30	(D)	(D)	678	49	0	49	(D)	(D)	127	(D)	(D)	501
Stone, clay, and glass products	32	(D)	(D)	863	(D)	(D)	103	(D)	(D)	418	(D)	(D)	262
Primary metals	33	749	34	715	89	0	89	(D)	(D)	240	(D)	(D)	386
Ferrous metals and products	331-32,3398-99	(D)	(D)	254	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	134
Nonferrous metals and products	333-36	(D)	(D)	461	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	253
Fabricated metal products	34	800	135	664	45	0	45	(D)	(D)	173	(D)	(D)	446
Machinery	35	14,635	1,157	13,478	(D)	(D)	(S)	(D)	(D)	2,774	(D)	(D)	(S)
Office, computing, and accounting machines	357	(D)	(D)	10,780	(D)	(D)	(S)	(D)	(D)	2,299	(D)	(D)	(S)
Other machinery, except electrical	351-56,358-59	(D)	(D)	2,698	91	0	91	(D)	(D)	475	2,210	78	2,132
Electrical equipment	36	16,929	5,288	11,641	(D)	(D)	544	(D)	(D)	2,912	12,129	3,944	8,185
Radio and TV receiving equipment	365	84	0	84	(D)	0	(D)	(D)	0	(D)	(D)	0	(D)
Communication equipment	366	10,539	4,719	5,820	(D)	28	(D)	(D)	(S)	(D)	8,452	3,552	4,900
Electronic components	367	4,990	532	4,458	(D)	(D)	96	(D)	(D)	1,996	(D)	(D)	2,366
Other electrical equipment	361-64,369	1,316	37	1,279	(S)	(D)	(D)	254	0	254	907	(D)	(D)
Transportation equipment	37	36,844	21,761	15,083	752	553	200	4,137	(D)	(D)	31,955	(D)	(D)
Motor vehicles and motor vehicles equipment	371	(D)	(D)	8,725	78	0	78	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	353	6	0	(S)	(D)	0	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	25,638	19,633	6,005	668	553	116	3,081	2,113	968	21,889	16,967	4,921

See explanatory information and SOURCE at end of table.

Table A-26. Funds for performance of basic research, applied research, and development, by industry and source of funds: 1989

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Industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
		[Dollars in millions]											
Professional and scientific instruments	38	5,743	113	5,630	(D)	(D)	440	1,279	27	1,252	(D)	(D)	3,939
Scientific and mechanical measuring instruments	381-82	1,868	(S)	1,858	(S)	0	(S)	(D)	(D)	366	1,369	0	1,369
Optical, surgical, photographic, and other instruments	383-87	3,875	103	3,772	(D)	(D)	316	(D)	(D)	886	(D)	(D)	2,570
Other manufacturing industries	27,31,39	(D)	(D)	400	(S)	0	(S)	60	0	60	301	1	300
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	8,286	2,666	5,620	1,032	614	418	2,190	828	1,361	5,064	1,224	3,840

NOTE: The character-of-work estimation procedure was revised for 1986 and later years: hence, these data are not directly comparable with data for 1985 and earlier years. See technical notes for a more comprehensive discussion of this change.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-27. Funds for performance of basic research, applied research, and development, by industry and source of funds: 1990

Page 1 of 2

Industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
		[Dollars in millions]											
Total		104,606	30,626	73,980	4,909	1,284	3,625	23,628	5,305	18,323	76,069	24,037	52,032
Food, kindred, and tobacco products	20-21	(D)	(D)	1,308	158	0	(S)	425	0	425	725	1	724
Textiles and apparel	22-23	(D)	(D)	242	(D)	0	(D)	39	0	39	170	(D)	(D)
Lumber, wood products, and furniture	24-25	183	0	183	(D)	0	(D)	(D)	0	(D)	92	0	92
Paper and allied products	26	730	0	730	(D)	0	(D)	(D)	0	(D)	500	0	500
Chemicals and allied products	28	12,344	67	12,277	(S)	(S)	(S)	4,986	12	4,974	6,489	50	6,439
Industrial chemicals	281-82,286	4,337	65	4,272	317	(S)	312	(D)	(D)	1,824	(D)	(D)	2,137
Drugs and medicines	283	(D)	(D)	5,366	(S)	0	(S)	(D)	(D)	2,299	(D)	(D)	2,610
Other chemicals	284-85,287-89	(D)	(D)	2,638	(S)	0	(S)	(D)	(D)	(S)	1,692	0	1,692
Petroleum refining and extraction	13,29	2,129	(S)	2,113	(D)	(D)	120	962	1	960	(D)	(D)	1,033
Rubber products	30	(D)	(D)	730	82	0	82	(D)	(D)	157	(D)	(D)	492
Stone, clay, and glass products	32	(D)	(D)	894	(D)	(D)	207	(D)	(D)	427	(D)	(D)	259
Primary metals	33	(D)	(D)	801	(S)	0	(S)	(D)	(D)	(S)	440	(D)	(D)
Ferrous metals and products	331-32,3398-99	(D)	(D)	245	(D)	0	(D)	(D)	(D)	124	118	(D)	(D)
Nonferrous metals and products	333-36	(D)	(D)	556	(D)	0	(D)	(D)	(D)	(S)	323	(D)	(D)
Fabricated metal products	34	778	134	644	53	0	53	195	(D)	(D)	530	(D)	(D)
Machinery	35	14,696	916	13,780	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	11,083
Office, computing, and accounting machines	357	(D)	(D)	11,073	(D)	(D)	155	(D)	(D)	2,018	9,273	373	8,900
Other machinery, except electrical	351-56,358-59	(D)	(D)	2,707	(D)	(D)	(D)	(D)	(D)	(D)	2,263	80	2,183
Electrical equipment	36	17,723	5,592	12,131	558	24	534	4,822	1,760	3,062	12,343	3,808	8,534
Radio and TV receiving equipment	365	93	0	93	(D)	0	(D)	(D)	0	(D)	62	0	62
Communication equipment	366	10,770	4,838	5,932	(D)	(D)	(D)	(D)	(D)	(D)	8,228	3,291	4,937
Electronic components	367	5,432	723	4,709	(D)	(D)	129	(D)	(D)	2,034	3,031	486	2,545
Other electrical equipment	361-64,369	1,428	31	1,397	104	0	104	302	0	302	1,022	31	990
Transportation equipment	37	36,019	21,027	14,992	775	519	256	(D)	(D)	2,169	(D)	(D)	12,567
Motor vehicles and motor vehicles equipment	371	(D)	(D)	8,548	110	0	110	972	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	304	8	0	8	(D)	0	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	25,356	19,216	6,140	658	519	139	3,340	1,931	1,409	21,358	16,766	4,592

See explanatory information and SOURCE at end of table.

Table A-27. Funds for performance of basic research, applied research, and development, by industry and source of funds: 1990

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Industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
		[Dollars in millions]											
Professional and scientific instruments	38	6,194	99	6,095	(D)	(D)	397	1,321	24	1,297	(D)	(D)	4,402
Scientific and mechanical measuring instruments	381-82	2,096	(S)	2,086	(D)	(D)	81	(D)	(D)	399	1,606	0	1,606
Optical, surgical, photographic, and other instruments	383-87	4,098	89	4,009	(D)	(D)	315	(D)	(D)	897	(D)	(D)	2,796
Other manufacturing industries	27,31,39	(D)	(D)	472	59	0	59	78	0	78	336	1	335
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9,274	2,686	6,588	1,146	671	475	2,317	769	1,548	5,811	1,246	4,565

NOTE: The character-of-work estimation procedure was revised for 1986 and later years: hence, these data are not directly comparable with data for 1985 and earlier years. See technical notes for a more comprehensive discussion of this change.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-28. Funds for performance of basic research, applied research, and development, by industry and source of funds: 1991

Page 1 of 2

Industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
		[Dollars in millions]											
Total		102,246	25,308	76,938	4,372	1,148	3,225	24,084	4,918	19,166	73,789	19,242	54,547
Food, kindred, and tobacco products	20-21	1,360	0	1,360	154	0	154	471	0	471	735	0	734
Textiles and apparel	22-23	(D)	(D)	215	(D)	0	(D)	(S)	0	(S)	138	(D)	(D)
Lumber, wood products, and furniture	24-25	160	0	160	(D)	0	(D)	60	0	60	(D)	0	(D)
Paper and allied products	26	715	0	715	(D)	0	(D)	186	0	186	(D)	0	(D)
Chemicals and allied products	28	13,183	89	13,094	835	6	829	5,338	17	5,321	7,011	(S)	6,945
Industrial chemicals	281-82,286	4,433	83	4,350	323	6	317	(D)	(D)	1,929	(D)	(D)	(S)
Drugs and medicines	283	(D)	(D)	6,098	(S)	0	(S)	(D)	(D)	2,610	3,077	1	3,076
Other chemicals	284-85,287-89	(D)	(D)	2,646	99	0	99	(D)	(D)	782	(D)	(D)	1,765
Petroleum refining and extraction	13,29	2,245	10	2,235	(D)	(D)	154	(D)	(D)	873	(D)	(D)	1,208
Rubber products	30	(D)	(D)	694	(S)	0	(S)	(D)	(D)	225	(D)	(D)	415
Stone, clay, and glass products	32	(D)	(D)	895	(D)	(D)	182	(D)	(D)	444	(D)	(D)	268
Primary metals	33	836	17	819	(S)	0	(S)	(D)	(D)	(S)	(D)	(D)	437
Ferrous metals and products	331-32,3398-99	(D)	(D)	244	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	127
Nonferrous metals and products	333-36	(D)	(D)	575	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	(S)
Fabricated metal products	34	756	130	626	19	0	19	(D)	(D)	138	(D)	(D)	469
Machinery	35	15,089	1,055	14,034	(D)	(D)	296	(D)	(D)	2,383	(D)	(D)	11,354
Office, computing, and accounting machines	357	(D)	(D)	10,527	(D)	(D)	167	(D)	(D)	1,748	(D)	(D)	8,612
Other machinery, except electrical	351-56,358-59	(D)	(D)	3,507	(D)	(D)	130	(D)	(D)	635	(D)	(D)	2,742
Electrical equipment	36	17,279	4,824	12,455	504	9	495	4,512	1,369	3,143	12,264	3,446	8,818
Radio and TV receiving equipment	365	78	0	78	(D)	0	(D)	(D)	0	(D)	(S)	0	(S)
Communication equipment	366	10,444	4,212	6,232	(D)	(D)	(D)	(D)	(D)	(D)	8,158	3,082	5,076
Electronic components	367	5,321	595	4,726	(D)	(D)	107	(D)	(D)	1,757	3,209	347	2,862
Other electrical equipment	361-64,369	1,436	17	1,419	79	0	79	523	0	523	835	(S)	(S)
Transportation equipment	37	32,091	16,217	15,874	657	470	187	4,413	2,139	2,274	27,021	13,608	13,413
Motor vehicles and motor vehicles equipment	371	(D)	(D)	8,998	87	0	87	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	288	11	0	11	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	21,692	15,104	6,588	559	471	89	3,248	1,731	1,517	17,884	12,902	4,982

See explanatory information and SOURCE at end of table.

Table A-28. Funds for performance of basic research, applied research, and development, by industry and source of funds: 1991

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Industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
		[Dollars in millions]											
Professional and scientific instruments	38	6,621	100	6,521	(D)	(D)	382	1,461	20	1,441	(D)	(D)	4,699
Scientific and mechanical measuring instruments	381-82	2,150	(S)	2,143	(D)	(D)	43	(D)	(D)	(S)	(D)	(D)	1,710
Optical, surgical, photographic, and other instruments	383-87	4,471	93	4,378	(D)	(D)	293	(D)	(D)	1,050	(D)	(D)	3,035
Other manufacturing industries	27,31,39	(D)	(D)	414	19	0	19	(D)	(D)	67	(D)	(D)	327
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9,642	2,815	6,827	937	607	330	2,599	823	1,777	6,106	1,386	4,720

NOTE: The character-of-work estimation procedure was revised for 1986 and later years: hence, these data are not directly comparable with data for 1985 and earlier years. See technical notes for a more comprehensive discussion of this change.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-29. Number of R&D-performing companies conducting basic research, by industry and size of company: 1991

Page 1 of 1

Industry	SIC code	Fewer than 500 employees		500 to 999 employees		1,000 to 4,999 employees		5,000 to 9,999 employees		10,000 to 24,999 employees		25,000 or more employees	
		Total	Basic research	Total	Basic research	Total	Basic research	Total	Basic research	Total	Basic research	Total	Basic research
Total		22,221	109	713	32	966	92	192	43	166	45	131	40
Food, kindred, and tobacco products	20-21	17	0	28	2	42	2	17	3	13	4	14	5
Textiles and apparel	22-23	288	1	109	0	44	0	6	2	9	1	2	1
Lumber, wood products, and furniture	24-25	78	0	28	1	31	1	7	0	3	1	1	0
Paper and allied products	26	256	0	12	0	29	3	10	0	9	1	5	0
Chemicals and allied products	28	2,326	2	31	8	56	19	17	9	22	8	7	4
Industrial chemicals	281-82,286	203	0	10	5	18	7	7	4	7	2	3	3
Drugs and medicines	283	407	1	6	1	7	1	3	2	11	5	2	1
Other chemicals	284-85,287-39	1,716	1	15	2	31	11	7	3	4	1	2	0
Petroleum refining	29	103	0	5	0	11	2	4	0	5	4	7	4
Rubber products	30	307	1	36	1	130	3	5	1	3	0	2	1
Stone, clay, and glass products	32	89	0	27	0	24	2	4	2	5	3	2	2
Primary metals	33	170	1	21	0	43	4	11	2	5	2	4	2
Ferrous metals and products	331-32,3398-99	80	0	9	0	23	1	6	0	2	0	3	1
Nonferrous metals and products	333-36	90	1	12	0	20	3	5	2	3	2	1	1
Fabricated metal products	34	1,799	0	61	1	54	5	7	2	9	2	1	0
Machinery	35	2,558	16	78	9	116	6	20	2	9	2	6	1
Office, computing, and accounting machines	357	436	7	16	3	28	1	9	0	2	0	3	1
Other machinery, except electrical	351-56,358-59	2,122	9	62	6	88	5	11	2	7	2	3	0
Electrical equipment	36	3,376	20	97	1	97	15	11	7	17	2	17	6
Radio and TV receiving equipment	365	172	1	3	0	3	1	1	0	0	0	0	0
Communication equipment	366	614	4	13	0	17	3	2	1	6	0	9	3
Electronic components	367	1,221	15	21	0	34	3	6	5	4	0	3	1
Other electrical equipment	361-64,369	1,369	0	60	1	43	8	2	1	7	2	5	2
Transportation equipment	37	161	5	25	2	35	2	14	6	15	6	18	8
Motor vehicles and motor vehicles equipment	371	103	0	18	1	20	0	8	4	4	1	4	1
Other transportation equipment	373-75,379	53	5	3	0	4	1	2	0	5	2	0	0
Aircraft and missiles	372,376	5	0	4	1	11	1	4	2	6	3	14	7
Professional and scientific instruments	38	1,771	11	36	2	41	4	7	2	3	1	5	[illegible]
Scientific and mechanical measuring instruments	381-82	948	9	13	0	[illegible]	1	2	0	2	0	1	0
Optical, surgical, photographic, and other instruments	383-87	823	2	23	2	23	3	5	2	1	1	4	1
Other manufacturing industries	27,31,39	312	1	31	0	38	4	7	2	5	1	2	1
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	8,610	50	88	5	175	20	45	3	34	7	38	4

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-30. Funds for industrial applied R&D performance, by product field and source of funds: 1991

Page 1 of 1

Product field	SIC code	Total	Federal	Company
		[Dollars in millions]		
Total		47,972	10,893	37,079
Food and kindred products	20	679	0	679
Textile mill products	22	60	(D)	(D)
Chemicals and allied products	28	6,946	94	6,852
Industrial inorganic and organic chemicals	281,286	684	(D)	(D)
Plastics materials and synthetic resins, rubber, and fibers	282	1,002	24	978
Drugs and medicines	283	3,628	(D)	(D)
Agricultural chemicals	287	614	(D)	(D)
Other chemicals	284-85,289	1,018	(D)	(D)
Petroleum refining	29	799	(D)	(D)
Rubber and miscellaneous plastics products	30	468	0	468
Stone, clay, and glass products	32	208	2	206
Primary metals	33	192	14	178
Ferrous metals and products	331-32,3398-99	123	(D)	(D)
Nonferrous metals and products	333-36	69	(D)	(D)
Fabricated metal products	34	1,685	1,239	446
Ordnance and accessories, n.e.c.	348	374	268	106
Other fabricated metal products	341-47,349	1,311	971	340
Machinery	35	7,680	200	7,480
Engines and turbines	351	976	140	836
Farm machinery and equipment	352	186	0	186
Construction, mining, and materials handling machinery	353	435	(D)	(D)
Metalworking machinery and equipment	354	179	(D)	(D)
Office, computing, and accounting machines	357	5,689	(D)	(D)
Other machinery, except electrical	355-56,358-59	215	(D)	(D)
Electrical equipment	36	7,079	2,256	4,823
Electric transmission and distribution equipment	361,3825	141	55	86
Electrical industrial apparatus	362	217	52	165
Radio and TV receiving equipment	365	116	(D)	(D)
Communication equipment	366	2,555	1,554	1,001
Electronic components	367	3,299	424	2,875
Other electrical equipment and supplies	363-64,368-69	751	(D)	(D)
Transportation equipment	37	12,112	3,796	8,316
Motor vehicles and equipment	371	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	(D)
Aircraft and parts	372	4,989	1,723	3,266
Guided missiles and spacecraft	376	2,315	1,980	335
Professional and scientific instruments	38, except 3825	1,585	560	1,025
Scientific and mechanical measuring instruments	381-82	967	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	618	(D)	(D)
Other product fields, n.e.c.		8,479	2,700	5,779

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
n.e.c. = Not elsewhere classified

NOTE: Imputation of R&D expenditures by product field was eliminated beginning in 1985. This table, therefore, contains only data reported by survey respondents. See table A-31 for coverage ratios showing the percentage of each industry's applied R&D funds that respondents distributed by product field.

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-31. Total (company, Federal, and other) funds for industrial applied R&D performance, by industry and product field: 1991

Page 1 of 2

Industry	SIC code	Coverage ratio	Total	Textile mill products 22	Chemicals 28	Petroleum refining 29	Rubber products 30
			[Dollars in millions]				
Total		0.61	79,838	60	6,946	799	468
Food, kindred, and tobacco products	20-21	0.78	1,009	0	39	0	(D)
Textiles and apparel	22-23	0.36	174	37	(D)	0	(D)
Lumber, wood products, and furniture	24-25	0.55	120	0	(D)	0	(D)
Paper and allied products	26	0.75	469	0	17	0	(D)
Chemicals and allied products	28	0.65	9,874	(D)	5,276	(D)	(D)
Industrial chemicals	281-82,286	0.51	2,920	(D)	1,228	(D)	(D)
Drugs and medicines	283	0.68	4,498	0	2,773	0	(D)
Other chemicals	284-85,287-89	0.76	2,466	(D)	1,275	0	0
Petroleum refining and extraction	13,29	0.93	1,485	0	442	671	(D)
Rubber products	30	0.79	503	0	55	0	(D)
Stone, clay, and glass products	32	0.36	757	(D)	(D)	0	(D)
Primary metals	33	0.42	602	0	(D)	(D)	(D)
Ferrous metals and products	331-32,3398-99	0.69	149	0	0	(D)	(D)
Nonferrous metals and products	333-36	0.33	453	0	(D)	0	0
Fabricated metal products	34	0.66	510	(D)	(D)	0	3
Machinery	35	0.74	14,280	(D)	9	(D)	9
Office, computing, and accounting machines	357	0.82	11,173	0	(D)	0	0
Other machinery, except electrical	351-56,358-59	0.45	3,107	(D)	(D)	(D)	9
Electrical equipment	36	0.34	13,950	0	13	0	15
Radio and TV receiving equipment	365	0.00	(S)	0	0	0	0
Communication equipment	366	0.32	8,787	0	(D)	0	0
Electronic components	367	0.39	3,943	0	(D)	0	(D)
Other electrical equipment	361-64,369	0.38	1,186	0	6	0	(D)
Transportation equipment	37	0.72	24,573	(D)	325	(D)	(D)
Motor vehicles and motor vehicles equipment	371	0.95	(D)	(D)	(D)	0	(D)
Other transportation equipment	373-75,379	0.76	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	0.62	16,893	(D)	(D)	(D)	2
Professional and scientific instruments	38	0.23	3,334	0	42	0	(D)
Scientific and mechanical measuring instruments	381-82	0.41	669	0	0	0	0
Optical, surgical, photographic, and other instruments	383-87	0.18	2,665	0	42	0	(D)
Other manufacturing industries	27,31,39	0.54	381	0	(D)	0	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	0.59	7,817	(D)	606	(D)	(D)

See explanatory information and SOURCE at end of table.

Table A-31. Total (company, Federal, and other) funds for industrial applied R&D performance, by industry and product field: 1991

Page 2 of 2

Industry	SIC code	Stone, clay, and glass products 32	Primary metals 33	Fabricated metal products 34	Machinery 35	Electrical equipment 36	Transportation equipment 37	Professional and scientific instruments 38	Other product fields n.e.c.
		[Dollars in millions]							
Total		208	192	1,685	7,680	7,079	12,112	1,585	8,479
Food, kindred, and tobacco products	20-21	(D)	(D)	(D)	(D)	(D)	0	0	236
Textiles and apparel	22-23	0	0	(D)	(D)	1	(D)	0	2
Lumber, wood products, and furniture	24-25	0	0	(D)	(D)	0	0	(D)	51
Paper and allied products	26	0	0	(D)	5	(D)	(D)	(D)	250
Chemicals and allied products	28	15	8	(D)	(D)	(D)	(D)	274	615
Industrial chemicals	281-82,286	0	(D)	0	(D)	(D)	0	(D)	(D)
Drugs and medicines	283	(D)	(D)	(D)	(D)	(D)	(D)	158	(D)
Other chemicals	284-85,287-89	(D)	(D)	(D)	(D)	5	0	(D)	516
Petroleum refining and extraction	13,29	(D)	(D)	(D)	(D)	(D)	(D)	(D)	153
Rubber products	30	(D)	(D)	(D)	(D)	(D)	(D)	0	16
Stone, clay, and glass products	32	134	0	(D)	0	(D)	(D)	(D)	(D)
Primary metals	33	0	98	21	(D)	85	(D)	(D)	11
Ferrous metals and products	331-32,3398-99	0	75	(D)	(D)	(D)	0	0	(D)
Nonferrous metals and products	333-36	0	23	(D)	(D)	(D)	(D)	(D)	(D)
Fabricated metal products	34	(D)	(D)	94	8	17	81	3	100
Machinery	35	6	(D)	59	6,264	2,008	62	14	2,045
Office, computing, and accounting machines	357	0	0	(D)	5,362	1,903	0	(D)	1,873
Other machinery, except electrical	351-56,358-59	6	(D)	(D)	902	105	62	(D)	172
Electrical equipment	36	(D)	(D)	(D)	151	1,881	37	123	1,119
Radio and TV receiving equipment	365	0	0	0	0	0	0	0	0
Communication equipment	366	0	(D)	(D)	25	381	(D)	(D)	(D)
Electronic components	367	0	0	(D)	28	1,340	(D)	(D)	(D)
Other electrical equipment	361-64,369	(D)	(D)	9	98	160	(D)	49	116
Transportation equipment	37	11	(D)	794	796	1,833	11,526	(D)	1,752
Motor vehicles and motor vehicles equipment	371	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	0	0	(D)	(D)	(D)	(D)	0	(D)
Aircraft and missiles	372,376	(D)	15	562	239	1,233	6,331	519	1,354
Professional and scientific instruments	38	0	(D)	(D)	10	186	(D)	460	45
Scientific and mechanical measuring instruments	381-82	0	0	0	(D)	139	(D)	119	(D)
Optical, surgical, photographic, and other instruments	383-87	0	(D)	(D)	(D)	47	0	341	(D)
Other manufacturing industries	27,31,39	0	(D)	0	(D)	(D)	0	(D)	153
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	25	1	(D)	400	900	359	122	1,928

KEY: n.e.c. = Not elsewhere classified
(D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

NOTE: Imputation of R&D expenditures by product field was eliminated beginning in 1985. Coverage ratios show the percentage of each industry's applied R&D funds that respondents distributed by product field.

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-32. Total (company, Federal, and other) funds for industrial applied R&D performance, by industry and detailed product field: 1991

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Industry	SIC code	Chemicals				
		Industrial inorganic and organic chemicals 281, 286	Plastics, synthetic resins, rubber, and fibers 282	Drugs and medicines 283	Agricultural chemicals 287	Other chemicals 284-85, 289
		[Dollars in millions]				
Total		684	1,002	3,628	614	1,018
Food, kindred, and tobacco products	20-21	(D)	(D)	0	(D)	(D)
Textiles and apparel	22-23	0	0	0	0	(D)
Lumber, wood products, and furniture	24-25	0	(D)	0	0	0
Paper and allied products	26	(D)	12	0	0	(D)
Chemicals and allied products	28	512	524	3,109	516	615
Industrial chemicals	281-82,286	343	(D)	(D)	(D)	(D)
Drugs and medicines	283	61	14	2,553	(D)	(D)
Other chemicals	284-85,287-89	108	(D)	(D)	154	481
Petroleum refining and extraction	13,29	26	191	(D)	(D)	222
Rubber products	30	(D)	34	(D)	0	(D)
Stone, clay, and glass products	32	(D)	22	0	0	(D)
Primary metals	33	(D)	(D)	0	0	0
Ferrous metals and products	331-32 3398-99	0	0	0	0	0
Nonferrous metals and products	333-36	(D)	(D)	0	0	0
Fabricated metal products	34	(D)	3	0	0	(D)
Machinery	35	(D)	6	0	0	(D)
Office, computing, and accounting machines	357	0	(D)	0	0	0
Other machinery, except electrical	351-56,358-59	(D)	(D)	0	0	(D)
Electrical equipment	36	9	(D)	0	0	(D)
Radio and TV receiving equipment	365	0	0	0	0	0
Communication equipment	366	(D)	(D)	0	0	0
Electronic components	367	(D)	(D)	0	0	0
Other electrical equipment	361-64,369	(D)	(D)	0	0	(D)
Transportation equipment	37	(D)	155	(D)	(D)	90
Motor vehicles and motor vehicles equipment	371	(D)	(D)	0	0	(D)
Other transportation equipment	373-75,379	(D)	(D)	(D)	(D)	0
Aircraft and missiles	372,376	(D)	(D)	0	0	(D)
Professional and scientific instruments	38	0	(D)	16	0	(D)
Scientific and mechanical measuring instruments	381-82	0	0	0	0	0
Optical, surgical, photographic, and other instruments	383-87	0	(D)	16	0	(D)
Other manufacturing industries	27,31,39	(D)	(D)	0	0	0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	32	(D)	492	(D)	(D)

See explanatory information and SOURCE at end of table.

Table A-32. Total (company, Federal, and other) funds for industrial applied R&D performance, by industry and detailed product field: 1991

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Industry	SIC code	Primary metals		Fabricated metal products
		Ferrous metals and products 331-32 3398-99	Nonferrous metal and products 333-36	Ordnance and accessories n.e.c. 348
		[Dollars in millions]		
Total		123	69	374
Food, kindred, and tobacco products	20-21	0	(D)	0
Textiles and apparel	22-23	0	0	0
Lumber, wood products, and furniture	24-25	0	0	0
Paper and allied products	26	0	0	0
Chemicals and allied products	28	(D)	(D)	0
Industrial chemicals	281-82,286	0	(D)	0
Drugs and medicines	283	0	(D)	0
Other chemicals	284-85,287-89	(D)	0	0
Petroleum refining and extraction	13,29	0	(D)	(D)
Rubber products	30	0	(D)	0
Stone, clay, and glass products	32	0	0	0
Primary metals	33	60	37	(D)
Ferrous metals and products	331-32,3398-99	60	14	0
Nonferrous metals and products	333-36	0	23	(D)
Fabricated metal products	34	(D)	(D)	(D)
Machinery	35	(D)	0	0
Office, computing, and accounting machines	357	0	0	0
Other machinery, except electrical	351-56,358-59	(D)	0	0
Electrical equipment	36	(D)	(D)	(D)
Radio and TV receiving equipment	365	0	0	0
Communication equipment	366	(D)	0	0
Electronic components	367	0	0	0
Other electrical equipment	361-64,369	(D)	(D)	(D)
Transportation equipment	37	(D)	18	191
Motor vehicles and motor vehicles equipment	371	(D)	(D)	(D)
Other transportation equipment	373-75,379	0	0	(D)
Aircraft and missiles	372,376	(D)	(D)	(D)
Professional and scientific instruments	38	(D)	(D)	(D)
Scientific and mechanical measuring instruments	381-82	0	0	0
Optical, surgical, photographic, and other instruments	383-87	(D)	(D)	(D)
Other manufacturing industries	27,31,39	0	(D)	0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	(D)	(D)	(D)

See explanatory information and SOURCE at end of table.

Table A-32. Total (company, Federal, and other) funds for industrial applied R&D performance, by industry and detailed product field: 1991

Page 3 of 5

Industry	SIC code	Machinery: Engines and turbines 351	Machinery: Farm machinery and equipment 352	Machinery: Construction, mining, and materials handling machinery 353	Machinery: Metalworking machinery and equipment 354	Machinery: Office, computing and accounting machines 357	Machinery: Other machinery, except electrical 355-56, 358-59
		[Dollars in millions]					
Total		976	186	435	179	5,689	215
Food, kindred, and tobacco products	20-21	0	(D)	0	0	0	(D)
Textiles and apparel	22-23	0	0	0	0	0	(D)
Lumber, wood products, and furniture	24-25	0	(D)	(D)	0	(D)	0
Paper and allied products	26	0	0	0	(D)	(D)	(D)
Chemicals and allied products	28	0	(D)	0	(D)	0	(D)
Industrial chemicals	281-82,286	0	(D)	0	(D)	0	(D)
Drugs and medicines	283	0	0	0	0	0	(D)
Other chemicals	284-85,287-89	0	0	0	0	0	(D)
Petroleum refining and extraction	13,29	(D)	0	(D)	0	(D)	(D)
Rubber products	30	0	0	(D)	0	0	(D)
Stone, clay, and glass products	32	0	0	0	0	0	0
Primary metals	33	0	0	0	(D)	0	(D)
Ferrous metals and products	331-32,3398-99	0	0	0	0	0	(D)
Nonferrous metals and products	333-36	0	0	0	(D)	0	(D)
Fabricated metal products	34	0	0	4	(D)	0	(D)
Machinery	35	262	(D)	337	80	5,361	(D)
Office, computing, and accounting machines	357	0	0	0	0	(D)	(D)
Other machinery, except electrical	351-56,358-59	262	(D)	337	80	(D)	52
Electrical equipment	36	(D)	0	(D)	(D)	23	33
Radio and TV receiving equipment	365	0	0	0	0	0	0
Communication equipment	366	0	0	0	(D)	(D)	(D)
Electronic components	367	0	0	(D)	0	(D)	(D)
Other electrical equipment	361-64,369	(D)	0	(D)	(D)	(D)	(D)
Transportation equipment	37	622	7	(D)	(D)	5	(D)
Motor vehicles and motor vehicles equipment	371	(D)	(D)	(D)	(D)	(D)	0
Other transportation equipment	373-75,379	0	(D)	(D)	0	0	(D)
Aircraft and missiles	372,376	(D)	(D)	(D)	11	(D)	(D)
Professional and scientific instruments	38	0	0	0	0	(D)	(D)
Scientific and mechanical measuring instruments	381-82	0	0	0	0	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	0	0	0	0	(D)	0
Other manufacturing industries	27,31,39	0	0	0	0	(D)	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	13	(D)	30	(D)	279	35

See explanatory information and SOURCE at end of table.

Table A-32. Total (company, Federal, and other) funds for industrial applied R&D performance, by industry and detailed product field: 1991

Industry	SIC code	Electrical equipment					
		Electric transmission and distribution equipment 361, 3825	Electrical industrial apparatus 362	Radio and television receiving sets, except communication types 365	Communication equipment 366	Electronic components and accessories 367	Other electrical equipment and supplies 363-64, 368-69
		[Dollars in millions]					
Total		141	217	116	2,555	3,299	751
Food, kindred, and tobacco products	20-21	0	(D)	0	0	0	0
Textiles and apparel	22-23	0	(D)	0	0	(D)	0
Lumber, wood products, and furniture	24-25	0	0	0	0	0	0
Paper and allied products	26	0	(D)	0	0	0	(D)
Chemicals and allied products	28	0	0	0	0	(D)	(D)
Industrial chemicals	281-82,286	0	0	0	0	(D)	0
Drugs and medicines	283	0	0	0	0	(D)	0
Other chemicals	284-85,287-89	0	0	0	0	(D)	(D)
Petroleum refining and extraction	13,29	0	0	0	0	(D)	0
Rubber products	30	0	0	0	0	(D)	(D)
Stone, clay, and glass products	32	0	0	(D)	(D)	(D)	0
Primary metals	33	(D)	(D)	0	(D)	(D)	(D)
Ferrous metals and products	331-32,3398-99	0	(D)	0	0	0	(D)
Nonferrous metals and products	333-36	(D)	0	0	(D)	(D)	(D)
Fabricated metal products	34	(D)	(D)	0	(D)	(D)	(D)
Machinery	35	(D)	40	(D)	(D)	1,335	178
Office, computing, and accounting machines	357	0	(D)	0	(D)	1,303	(D)
Other machinery, except electrical	351-56,358-59	(D)	(D)	(D)	1	32	(D)
Electrical equipment	36	25	66	(D)	537	1,121	(D)
Radio and TV receiving equipment	365	0	0	0	0	0	0
Communication equipment	366	0	(D)	(D)	309	49	(D)
Electronic components	367	0	0	(D)	(D)	1,046	75
Other electrical equipment	361-64,369	25	(D)	0	(D)	26	46
Transportation equipment	37	(D)	69	(D)	892	389	332
Motor vehicles and motor vehicles equipment	371	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	0	(D)	(D)	0
Aircraft and missiles	372,376	(D)	(D)	(D)	515	(D)	(D)
Professional and scientific instruments	38	0	16	0	63	99	7
Scientific and mechanical measuring instruments	381-82	0	(D)	0	(D)	80	(D)
Optical, surgical, photographic, and other instruments	383-87	0	(D)	0	(D)	19	(D)
Other manufacturing industries	27,31,39	0	0	0	0	0	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	61	(D)	(D)	519	218	77

See explanatory information and SOURCE at end of table.

Table A-32. Total (company, Federal, and other) funds for industrial applied R&D performance, by industry and detailed product field: 1991

Page 5 of 5

Industry	SIC code	Transportation equipment				Professional and scientific instruments	
		Motor vehicles and equipment 371	Other transportation equipment 379	Aircraft and parts 372	Guided missiles and spacecraft 376	Scientific and mechanical measuring instruments 381-82	Optical, surgical, photographic, and other instruments 383-87
		[Dollars in millions]					
Total		(D)	(D)	4,989	2,315	967	618
Food, kindred, and tobacco products	20-21	0	0	0	0	0	0
Textiles and apparel	22-23	(D)	0	0	0	0	0
Lumber, wood products, and furniture	24-25	0	0	0	0	(D)	0
Paper and allied products	26	(D)	0	0	0	(D)	0
Chemicals and allied products	28	(D)	0	0	0	(D)	(D)
Industrial chemicals	281-82,286	0	0	0	0	0	(D)
Drugs and medicines	283	(D)	0	0	0	(D)	(D)
Other chemicals	284-85,287-89	0	0	0	0	(D)	(D)
Petroleum refining and extraction	13,29	(D)	(D)	(D)	(D)	(D)	0
Rubber products	30	(D)	(D)	0	(D)	0	0
Stone, clay, and glass products	32	(D)	0	(D)	0	(D)	(D)
Primary metals	33	(D)	(D)	(D)	(D)	(D)	(D)
Ferrous metals and products	331-32,3398-99	0	0	0	0	0	0
Nonferrous metals and products	333-36	(D)	(D)	(D)	(D)	(D)	(D)
Fabricated metal products	34	12	(D)	(D)	(D)	(D)	(D)
Machinery	35	34	9	(D)	(D)	(D)	(D)
Office, computing, and accounting machines	357	0	0	0	0	(D)	(D)
Other machinery, except electrical	351-56,358-59	34	9	(D)	(D)	(D)	0
Electrical equipment	36	(D)	(D)	32	(D)	(D)	(D)
Radio and TV receiving equipment	365	0	0	0	0	0	0
Communication equipment	366	0	(D)	(D)	(D)	(D)	(D)
Electronic components	367	0	(D)	(D)	0	(D)	(D)
Other electrical equipment	361-64,369	(D)	0	(D)	(D)	(D)	(D)
Transportation equipment	37	(D)	(D)	4,796	2,037	(D)	(D)
Motor vehicles and motor vehicles equipment	371	(D)	(D)	(D)	(D)	(D)	0
Other transportation equipment	373-75,379	16	(D)	(D)	(D)	0	0
Aircraft and missiles	372,376	91	68	4,648	1,524	(D)	(D)
Professional and scientific instruments	38	0	0	(D)	0	188	271
Scientific and mechanical measuring instruments	381-82	0	0	(D)	0	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	0	0	0	0	(D)	(D)
Other manufacturing industries	27,31,39	0	0	0	0	0	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9	17	76	258	114	9

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.

NOTE: Imputation of R&D expenditures by product field was eliminated beginning in 1985. This table, therefore, contains only data reported by survey respondents. See table A-31 for coverage ratios showing the percentage of each industry's applied research and development funds that respondents distributed by product field.

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-33. Total (company, Federal, and other) funds for industrial energy R&D performance, by industry: 1981-91 and projected 1992

Page 1 of 1

Industry	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Projected 1992
		[Dollars in millions]											
Total		4,216	4,240	4,345	4,446	3,954	3,358	3,576	3,738	3,536	4,105	4,736	4,786
Food, kindred, and tobacco products 1/	20-21	5	(T)	(T)	(S)	2	2	(S)	2/	(D)	(D)	(D)	(D)
Textiles and apparel	22-23	(T)	(T)	(T)	2	1	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Lumber, wood products, and furniture	24-25	4	5	5	5	3	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Paper and allied products	26	2	3	3	6	(D)	(D)	1	1	(D)	(D)	(D)	(D)
Chemicals and allied products	28	312	347	345	191	162	(S)	(S)	(S)	130	(S)	(S)	(S)
Industrial chemicals	281-82,286	305	338	335	181	(D)	(D)	(D)	(D)	128	(D)	(S)	(D)
Drugs and medicines	283	(T)	(T)	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other chemicals	284-85,287-89	(T)	(T)	(T)	(D)	2	2	2	4	(D)	1	(D)	(D)
Petroleum refining and extraction	13,29	1,067	1,162	1,284	1,356	1,199	999	914	989	989	966	1,089	1,007
Rubber products	30	17	14	17	16	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Stone, clay, and glass products	32	24	17	7	5	(D)	(D)	1	(D)	1	(D)	(D)	(D)
Primary metals	33	80	101	92	(S)	(S)	74	18	21	(D)	(D)	26	26
Ferrous metals and products	331-32,3398-99	20	22	35	35	26	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Nonferrous metals and products	333-36	59	79	57	(S)	(S)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Fabricated metal products	34	(T)	54	31	(D)	8	(D)	(D)	(D)	14	49	(S)	(S)
Machinery	35	127	183	163	201	240	261	(D)	230	253	236	148	149
Office, computing, and accounting machines	357	6	16	(T)	(S)	12	(D)	(D)	(D)	(D)	0	0	0
Other machinery, except electrical	351-56,358-59	121	167	144	179	228	(D)	(D)	(D)	(D)	236	148	149
Electrical equipment	36	908	831	813	752	733	(D)	578	744	762	820	1,045	1,048
Radio and TV receiving equipment	365	(T)	5	0	0	0	0	0	0	0	0	0	0
Communication equipment	366	(T)	155	150	(D)	115	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Electronic components	367	15	40	82	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other electrical equipment	361-64,369	(T)	631	581	618	(D)	(D)	(S)	(D)	(D)	20	96	143
Transportation equipment	37	(T)	(T)	(T)	(D)	(S)	(S)	(S)	(D)	847	(S)	(D)	(D)
Motor vehicles and motor vehicles equipment	371	(T)	(T)	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(T)	2	2	1	(D)	(D)	(D)	(D)	(D)	(D)	0	0
Aircraft and missiles	372,376	412	363	425	661	681	537	754	726	614	(S)	(S)	(S)
Professional and scientific instruments	38	53	54	45	36	(D)	(D)	17	16	12	11	(S)	(S)
Scientific and mechanical measuring instruments	381-82	(T)	(T)	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	(T)	(T)	(T)	(D)	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)
Other manufacturing industries 1/	27,31,39	(T)	12	17	12	0	0	0	0	(D)	(D)	(D)	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	374	375	349	424	338	328	433	489	496	598	607	(S)

1/ Until 1984, tobacco products (SIC 21) was included with "Other manufacturing industries."

2/ Less than $0.5 million.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.
(T) = Data are not separately available, but are included in total.

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-34. Company and other (except Federal) funds for industrial energy R&D performance, by selected industry: 1981-91 and projected 1992

Page 1 of 1

Industry	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Projected 1992
		[Dollars in millions]											
Total		2,680	2,762	2,842	2,962	2,537	2,167	2,410	2,353	2,271	2,687	2,733	2,754
Chemicals and allied products	28	149	178	166	169	(D)	(D)	(D)	(D)	99	(S)	(S)	(S)
Petroleum refining and extraction	13,29	957	1,096	1,218	(D)	1,145	957	911	983	985	963	1,082	998
Machinery	35	(T)	(T)	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Electrical equipment	36	203	146	132	123	71	(D)	(D)	(D)	(D)	378	(S)	(D)
Aircraft and missiles	372,376	124	99	(T)	190	264	236	(D)	279	246	(D)	(D)	(S)
All other manufacturing industries		1,053	1,079	(T)	779	610	497	564	478	(D)	(D)	(D)	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	194	164	143	189	84	(D)	170	(S)	243	282	264	(S)

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.
(T) = Data are not separately available, but are included in total.

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-35. Federal funds for industrial energy R&D performance, by selected industry: 1981-91 and projected 1992

Page 1 of 1

Industry	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Projected 1992
		[Dollars in millions]											
Total		1,536	1,478	1,503	1,484	1,417	1,191	1,166	1,385	1,265	1,418	2,003	2,032
Chemicals and allied products	28	163	169	179	22	(D)	(D)	(D)	(D)	31	16	(S)	(S)
Petroleum refining and extraction	13,29	110	66	66	(D)	54	42	3	6	4	3	7	9
Machinery	35	(T)	(T)	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Electrical equipment	36	705	685	681	629	662	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	288	264	(T)	471	417	302	(D)	447	368	445	(S)	(S)
All other manufacturing industries		90	83	(T)	52	13	4	5	(D)	(D)	(D)	(D)	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	180	211	206	235	254	(D)	263	(S)	253	316	331	(S)

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.
(T) = Data are not separately available, but are included in total.

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-36. Total (company, Federal, and other) funds for industrial energy R&D performance, by primary energy source: 1981-91 and projected 1992

[Dollars in millions]

Page 1 of 1

Primary energy source	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Projected 1992
Total	4,216	4,240	4,345	4,446	3,954	3,358	3,576	3,738	3,536	4,105	4,736	4,786
Fossil fuels	1,437	1,491	1,573	1,738	1,876	1,476	1,548	1,606	1,601	1,810	2,037	(S)
Oil	772	N/A	905	N/A	1,395	N/A	(S)	N/A	(S)	N/A	(S)	(S)
Gas	208	N/A	255	N/A	189	N/A	191	N/A	(S)	N/A	(S)	(S)
Shale	57	N/A	48	N/A	125	N/A	11	N/A	72	N/A	(S)	(S)
Coal	383	N/A	(T)	N/A	150	N/A	46	N/A	(S)	N/A	(S)	(S)
Synthetic fossil fuels	210	N/A	(T)	N/A	111	N/A	23	N/A	14	N/A	(S)	(S)
Mining	31	N/A	(T)	N/A	8	N/A	3	N/A	(S)	N/A	(S)	(S)
Other	142	N/A	(T)	N/A	31	N/A	(S)	N/A	(S)	N/A	(S)	65
Other fossil fuels	17	N/A	(T)	N/A	17	N/A	51	N/A	(S)	N/A	58	(S)
Nuclear	1,037	1,078	1,118	1,113	1,212	979	926	1,097	943	1,065	1,190	1,148
Fission	866	N/A	973	N/A	1,062	N/A	859	N/A	866	N/A	1,185	1,143
Fusion	171	N/A	145	N/A	150	N/A	(S)	N/A	77	N/A	5	(S)
Total geothermal, solar, and conservation and utilization	774	N/A	1,424	1,218	471	504	421	497	582	594	(S)	(S)
Geothermal	71	N/A	(T)	N/A	54	N/A	48	N/A	16	N/A	(S)	(S)
Solar	298	N/A	(T)	N/A	96	N/A	95	N/A	(S)	N/A	(S)	(S)
Conservation and utilization	405	N/A	(T)	N/A	321	N/A	281	N/A	417	N/A	(S)	(S)
All other energy	968	N/A	230	377	395	399	(S)	538	410	636	604	704

KEY: (S) = Data have been withheld because of imputation of more than 50 percent.
(T) = Data are not separately available, but are included in total.
N/A = Not available

NOTE: Detailed data for 1981, 1983, 1985, 1987, and 1989 were estimated on the basis of (a) data actually reported in those years, (b) revised data for those years reported on the 1982, 1984, 1986, 1988, and 1990 survey forms, and (c) adjustments due to new samples in 1981 and 1987.

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-37. Company and other (except Federal) funds for industrial energy R&D performance, by primary energy source: 1981-91 and projected 1992

[Dollars in millions]

Page 1 of 1

Primary energy source	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Projected 1992
Total	2,680	2,762	2,842	2,962	2,537	2,167	2,410	2,353	2,271	2,687	2,733	2,754
Fossil fuels	1,257	1,361	1,455	1,509	1,797	(D)	(D)	1,543	(D)	(D)	(S)	(S)
Oil	746	N/A	(T)	N/A	1,381	N/A	(S)	N/A	(S)	N/A	(S)	(S)
Gas	(T)	N/A	(T)	N/A	(D)	N/A	(S)	N/A	(S)	N/A	(S)	(S)
Shale	(T)	N/A	(T)	N/A	124	N/A	(S)	N/A	(S)	N/A	(S)	(S)
Coal	244	N/A	(T)	N/A	(S)	N/A	29	N/A	(S)	N/A	(S)	(S)
Synthetic fossil fuels	132	N/A	(T)	N/A	91	N/A	(S)	N/A	(D)	N/A	(S)	(D)
Mining	24	N/A	(T)	N/A	8	N/A	(D)	N/A	(D)	N/A	(D)	(D)
Other	89	N/A	(T)	N/A	(S)	N/A	(D)	N/A	(S)	N/A	(D)	47
Other fossil fuels	(T)	N/A	(T)	N/A	17	N/A	(S)	N/A	(S)	N/A	(S)	(S)
Nuclear	126	99	90	101	150	91	109	118	84	180	52	45
Fission	70	N/A	71	N/A	135	N/A	82	N/A	57	N/A	51	44
Fusion	56	N/A	19	N/A	15	N/A	(S)	N/A	27	N/A	1	1
Total geothermal, solar, and conservation and utilization	573	N/A	1,147	1,086	313	(D)	(D)	319	(D)	(D)	(S)	(S)
Geothermal	40	N/A	(T)	N/A	27	N/A	(D)	N/A	(D)	N/A	(S)	(S)
Solar	199	N/A	(T)	N/A	51	N/A	41	N/A	(D)	N/A	(S)	(S)
Conservation and utilization	334	N/A	(T)	N/A	235	N/A	(D)	N/A	281	N/A	(S)	(S)
All other energy	724	N/A	150	267	277	(D)	(D)	373	(D)	462	(S)	453

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.
(T) = Data are not separately available but are included in total.
N/A = Not available

NOTE: Detailed data for 1981, 1983, 1985, 1987, and 1989 were estimated on the basis of (a) data actually reported in those years, (b) revised data for those years reported on the 1982, 1984, 1986, 1988, and 1990 survey forms, and (c) adjustments due to new samples in 1981 and 1987.

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-38. Federal funds for industrial energy R&D performance, by primary energy source: 1981-91 and projected 1992

[Dollars in millions]

Page 1 of 1

Primary energy source	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Projected 1992
Total	1,536	1,478	1,503	1,484	1,417	1,191	1,166	1,385	1,265	1,418	2,003	2,032
Fossil fuels	180	130	117	228	78	(D)	(D)	63	(D)	(D)	(S)	(S)
Oil	26	N/A	(T)	N/A	13	N/A	(S)	N/A	(S)	N/A	(S)	(S)
Gas	(T)	N/A	10	N/A	(D)	N/A	(D)	N/A	(S)	N/A	(S)	(S)
Shale	(T)	N/A	1	N/A	1	N/A	(D)	N/A	(S)	N/A	(S)	(S)
Coal	139	N/A	76	N/A	(S)	N/A	17	N/A	(S)	N/A	(S)	(S)
Synthetic fossil fuels	78	N/A	(T)	N/A	20	N/A	8	N/A	(D)	N/A	(S)	(D)
Mining	7	N/A	(T)	N/A	0	N/A	(D)	N/A	(D)	N/A	(D)	(D)
Other	53	N/A	(T)	N/A	(S)	N/A	(D)	N/A	(S)	N/A	(D)	(S)
Other fossil fuels	(T)	N/A	16	N/A	0	N/A	1	N/A	(S)	N/A	(S)	(S)
Nuclear	911	979	1,029	1,013	1,063	888	817	979	859	885	1,138	1,103
Fission	796	N/A	902	N/A	928	N/A	777	N/A	809	N/A	1,134	1,099
Fusion	115	N/A	127	N/A	135	N/A	(S)	N/A	50	N/A	4	4
Total geothermal, solar, and conservation and utilization	201	N/A	277	132	158	(D)	(D)	178	(D)	(D)	(S)	(S)
Geothermal	31	N/A	(T)	N/A	26	N/A	(D)	N/A	(D)	N/A	11	(S)
Solar	99	N/A	(T)	N/A	45	N/A	37	N/A	(D)	N/A	38	(S)
Conservation and utilization	71	N/A	80	N/A	87	N/A	(D)	N/A	(D)	N/A	(S)	(S)
All other energy	244	N/A	80	110	118	(D)	(D)	165	(D)	174	(S)	(S)

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.
(T) = Data are not separately available, but are included in total.
N/A = Not available

NOTE: Detailed data for 1981, 1983, 1985, 1987, and 1989 were estimated on the basis of (a) data actually reported in those years, (b) revised data for those years reported on the 1980, 1982, 1984, 1986, 1988, and and 1990 survey forms, and (c) adjustments due to new samples in 1981 and 1987.

SOURCE: National Science Foundation/SRS, Survey of Industrial Research and Development: 1991

Table A-39. Number of companies performing energy research and development and total number of R&D performing companies, by industry and size of company: 1991

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Industry	SIC code	Size of company											
		Fewer than 500 employees		500 to 999 employees		1,000 to 4,999 employees		5,000 to 9,999 employees		10,000 to 24,999 employees		25,000 or more employees	
		Total	Energy	Total	Energy	Total	Energy	Total	Energy	Total	Energy	Total	Energy
Total		22,221	29	713	15	966	31	192	25	166	26	131	25
Food, kindred, and tobacco products	20-21	17	0	28	0	42	0	17	0	13	1	14	1
Textiles and apparel	22-23	288	0	109	0	44	1	6	0	9	0	2	0
Lumber, wood products, and furniture	24-25	78	0	28	0	31	1	7	0	3	0	1	0
Paper and allied products	26	256	0	12	0	29	0	10	1	9	0	5	1
Chemicals and allied products	28	2,326	1	31	1	56	4	17	1	22	1	7	1
Industrial chemicals	281-82,286	203	0	10	1	18	4	7	1	7	0	3	1
Drugs and medicines	283	407	0	6	0	7	0	3	0	11	1	2	0
Other chemicals	284-85,287-89	1,716	1	15	0	31	0	7	0	4	0	2	0
Petroleum refining	29	103	0	5	0	11	0	4	1	5	3	7	6
Rubber products	30	307	0	36	0	130	2	5	0	3	0	2	0
Stone, clay, and glass products	32	89	0	27	0	24	2	4	0	5	1	2	1
Primary metals	33	170	0	21	0	43	2	11	0	5	2	4	1
Ferrous metals and products	331-32,3398-99	80	0	9	0	23	0	6	0	2	1	3	1
Nonferrous metals and products	333-36	90	0	12	0	20	2	5	0	3	1	1	0
Fabricated metal products	34	1,799	11	61	0	54	0	7	1	9	1	1	0
Machinery	35	2,558	1	78	4	116	4	20	2	9	1	6	1
Office, computing, and accounting machines	357	436	0	16	0	28	0	9	0	2	0	3	0
Other machinery, except electrical	351-56,358-59	2,122	1	62	4	88	4	11	2	7	1	3	1
Electrical equipment	36	3,376	1	97	9	97	2	11	1	17	1	17	4
Radio and TV receiving equipment	365	172	0	3	0	3	0	1	0	0	0	0	0
Communication equipment	366	614	1	13	0	17	1	2	0	6	0	9	3
Electronic components	367	1,221	0	21	0	34	0	6	1	4	0	3	0
Other electrical equipment	361-64,369	1,369	0	60	9	43	1	2	0	7	1	5	1
Transportation equipment	37	161	0	25	0	35	0	14	2	15	2	18	5
Motor vehicles and motor vehicles equipment	371	103	0	18	0	20	0	8	0	4	1	4	0
Other transportation equipment	373-75,379	53	0	3	0	4	0	2	0	5	0	0	0
Aircraft and missiles	372,376	5	0	4	0	11	0	4	2	6	1	14	5
Professional and scientific instruments	38	1,771	1	36	0	41	2	7	0	3	0	5	0
Scientific and mechanical measuring instruments	381-82	948	1	13	0	18	0	2	0	2	0	1	0
Optical, surgical, photographic, and other instruments	383-87	823	0	23	0	23	2	5	0	1	0	4	0
Other manufacturing industries	27,31,39	312	0	31	0	38	0	7	0	5	0	2	0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	8,610	14	88	1	175	11	45	16	34	13	38	4

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-40. Total (company, Federal, and other) funds for industrial pollution abatement R&D performance, by industry: 1981-91 and projected 1992

[Dollars in millions]

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Industry	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Projected 1992
Total		(S)	(S)	(S)	1,060	(S)	(S)	(S)	(S)	1,372	1,044	(S)	(S)
Food, kindred, and tobacco products 1/	20-21	1	1	9	12	1	1	1	1	3	2	4	(D)
Textiles and apparel	22-23	(T)	(T)	(T)	(S)	2/	(D)	2/	(S)	2/	2/	2/	2/
Lumber, wood products, and furniture	24-25	5	3	2	(D)	1	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Paper and allied products	26	(T)	9	6	7	8	7	7	9	19	18	17	21
Chemicals and allied products	28	186	191	167	158	(S)	168	117	136	178	163	(S)	(S)
Industrial chemicals	281-82,286	165	173	144	140	(S)	(S)	(D)	117	61	(D)	(S)	(S)
Drugs and medicines	283	6	6	11	8	(D)	(D)	(D)	(D)	(D)	(D)	15	22
Other chemicals	284-85,287-89	15	12	12	10	14	(D)	12	(D)	(D)	67	(S)	(S)
Petroleum refining and extraction	13,29	92	97	81	88	60	63	51	60	75	72	110	110
Rubber products	30	(T)	2	1	(D)	(D)	(D)	(D)	(S)	1	1	2/	2/
Stone, clay, and glass products	32	9	7	9	(S)	3	4	(D)	(D)	(D)	(D)	(D)	(D)
Primary metals	33	24	22	21	21	20	8	5	9	10	8	(S)	(S)
Ferrous metals and products	331-32,3398-99	15	13	10	13	11	2	(D)	(D)	(D)	(D)	(D)	(D)
Nonferrous metals and products	333-36	9	9	11	8	9	6	(D)	(D)	(D)	(D)	(D)	(D)
Fabricated metal products	34	3	11	7	14	6	(D)	(D)	(D)	1	2	(S)	(S)
Machinery	35	34	30	27	26	26	33	38	46	111	116	(S)	(S)
Office, computing, and accounting machines	357	0	0	0	(D)	0	0	0	0	0	0	(D)	(D)
Other machinery, except electrical	351-56,358-59	34	30	27	(D)	26	33	38	46	111	116	(D)	(D)
Electrical equipment	36	39	24	18	(D)	(D)	5	(D)	(D)	9	11	12	53
Radio and TV receiving equipment	365	0	0	0	0	0	0	0	0	0	0	0	0
Communication equipment	366	(T)	(T)	(T)	(D)	1	1	(D)	(D)	7	8	9	51
Electronic components	367	(T)	(T)	(T)	(S)	2/	(D)	(D)	0	(D)	2	(D)	(D)
Other electrical equipment	361-64,369	(T)	(T)	12	(D)	(D)	(D)	(D)	(D)	(D)	1	(D)	(D)
Transportation equipment	37	(T)	(T)	(T)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(D)	(D)
Motor vehicles and motor vehicles equipment	371	(T)	(T)	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	0	0	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	0	0
Aircraft and missiles	372,376	30	(T)	(T)	(D)	(S)	87	123	103	120	195	169	190
Professional and scientific instruments	38	(T)	(T)	3	2	2	(D)	(D)	3	(D)	4	6	(D)
Scientific and mechanical measuring instruments	381-82	(T)	(T)	1	(D)	(D)	(D)	(D)	(D)	(D)	(D)	2/	2/
Optical, surgical, photographic, and other instruments	383-87	(T)	(T)	2	(D)	(D)	(D)	(D)	(D)	(D)	(D)	5	(D)
Other manufacturing industries	27,31,39	(T)	(T)	2	3	(S)	0	(D)	(D)	1	2/	(D)	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	77	65	124	113	118	80	113	(S)	(S)	(S)	(S)	(S)

1/ Until 1984, tobacco products (SIC 21) was included with "Other manufacturing industries."

2/ Less than $0.5 million.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.

(S) = Data have been withheld because of imputation of more than 50 percent.

(T) = Data are not separately available, but are included in total.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-41. Company and other (except Federal) funds for industrial pollution-abatement R&D performance, by selected industry: 1981-91 and projected 1992

[Dollars in millions]

Page 1 of 1

Industry	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Projected 1992
Total		(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	955	(S)	(S)
Chemicals and allied products	28	128	123	101	(D)	(S)	(D)	(D)	(D)	(D)	163	(D)	(D)
Petroleum refining and extraction	13,29	92	97	82	(D)	61	63	51	60	(D)	(D)	(D)	(D)
Machinery	35	(T)	(T)	(T)	(D)	(D)	33	38	46	(D)	116	(D)	(D)
Electrical equipment	36	19	12	13	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	20	22	17	24	(D)	(D)	62	(D)	70	(D)	(D)	(D)
All other manufacturing industries		(T)	(T)	(T)	565	(D)	676	(D)	(D)	737	406	550	621
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	39	38	51	47	(D)	(D)	(D)	(D)	58	(D)	(S)	(D)

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of 50 percent or more.
(T) = Data are not separately available but are included in total.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-42. Federal funds for industrial pollution-abatement R&D performance, by selected industry: 1981-91 and projected 1992

[Dollars in millions]

Page 1 of 1

Industry	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Projected 1992
Total		129	122	176	169	169	148	186	191	(S)	88	91	131
Chemicals and allied products	28	58	68	66	(D)	(D)	(D)	(D)	(D)	(D)	0	(D)	(D)
Petroleum refining and extraction	13,29	0	0	0	(D)	0	0	0	0	(D)	(D)	(D)	(D)
Machinery	35	(T)	(T)	(T)	(D)	(D)	0	0	0	(D)	0	(D)	(D)
Electrical equipment	36	20	12	5	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	10	(T)	(T)	(D)	(D)	(D)	61	(D)	50	(D)	(D)	(D)
All other manufacturing industries		3	(T)	(T)	(D)	(D)	(D)	(D)	0	0	(D)	(D)	0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	38	26	74	67	(D)	(D)	(D)	(D)	(D)	(D)	17	(D)

KEY: (D) = Data have been withheld to avoid disclosing information about individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.
(T) = Data are not separately available but are included in total.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-43. Total (company, Federal, and other) funds for industrial pollution-abatement R&D performance, by type of pollution: 1981-91 and projected 1992

[Dollars in millions]

Page 1 of 1

Type of pollution	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Projected 1992
Total	(S)	(S)	(S)	1,060	(S)	(S)	(S)	(S)	(S)	1,044	(S)	(S)
Air	(S)	1/	(S)	1/	(S)	1/	(S)	1/	(S)	1/	(S)	(S)
Automotive emission	(S)	1/	(S)	1/	(D)	1/	(S)	1/	(S)	1/	(S)	(S)
Electric power plant emissions	27	1/	23	1/	12	1/	16	1/	36	1/	(S)	(S)
All other	112	1/	91	1/	(D)	1/	(S)	1/	(S)	1/	(S)	(S)
Water	105	1/	124	1/	(S)	1/	(S)	1/	(S)	1/	(S)	(S)
Solid waste	96	1/	108	1/	(S)	1/	206	1/	(S)	1/	(S)	(S)
Other	65	1/	54	1/	108	1/	90	1/	85	1/	(S)	191

1/ Data not collected

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

NOTE: Detailed data for 1981, 1983, 1985, 1987, and 1989 were estimated on the basis of (a) data actually reported in those years, (b) revised totals for those years which were reported on the 1982, 1984, 1986, 1988, and 1990 survey forms, and (c) adjustments due to new samples in 1981 and 1987.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-44. Total (company, Federal, and other) funds for industrial pollution-abatement R&D performance, by type of pollution and source of funds: 1990-91 and projected 1992

[Dollars in millions]

Page 1 of 1

Type of pollution	1990			1991			1992 (projected)		
	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
Total	1,044	89	955	(S)	91	(S)	(S)	131	(S)
Air	1/	1/	1/	(S)	(S)	(S)	(S)	97	(S)
Automotive emission	1/	1/	1/	(S)	(D)	(D)	(S)	(D)	(D)
Electric power plant emissions	1/	1/	1/	(S)	(D)	(D)	(S)	(S)	(S)
All other	1/	1/	1/	(S)	5	(S)	(S)	(D)	(D)
Water	1/	1/	1/	(S)	(D)	(D)	(S)	(D)	(D)
Solid waste	1/	1/	1/	(S)	(D)	(D)	(S)	(D)	(D)
Other	1/	1/	1/	(S)	(D)	(D)	191	(S)	166

1/ Data not collected

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-45. Geographic distribution of total (company, Federal, and other) funds for industrial R&D performance in selected years

[Dollars in millions]

Page 1 of 2

Area	1974	1975	1976	1977	1979	1981	1983	1985	1987	1989	1991
United States	22,887	24,187	26,997	29,825	38,226	51,810	62,816	78,203	96,305	101,599	102,246
Northeast	7,291	7,403	8,096	8,687	10,296	14,270	18,245	23,057	25,654	27,873	30,748
New England	2,058	2,029	2,147	2,400	3,003	3,855	4,504	6,922	8,324	8,789	(S)
Maine	8	9	21	24	40	(T)	(T)	(D)	41	33	(S)
New Hampshire	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(D)	94	(D)	(D)
Vermont	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(D)	247	(D)	(D)
Massachusetts	1,080	1,022	1,156	1,349	1,690	1,907	2,373	4,173	5,492	5,825	(S)
Rhode Island	41	45	22	24	49	87	165	198	234	139	152
Connecticut	821	832	815	876	985	1,514	1,619	1,976	2,216	2,410	1,535
Middle Atlantic	5,233	5,374	5,949	6,287	7,293	10,415	13,741	16,136	17,330	19,084	22,340
New York	2,134	2,225	2,418	2,542	2,959	4,057	5,727	7,019	6,559	8,071	8,268
New Jersey	1,512	1,547	1,717	1,900	2,191	3,355	4,200	5,547	6,141	6,381	7,810
Pennsylvania	1,537	1,602	1,814	1,845	2,143	3,003	3,614	3,569	4,630	4,632	(S)
North Central	5,756	5,821	6,574	7,777	10,013	12,692	14,672	18,001	24,224	24,615	25,295
East North Central	4,704	4,816	5,390	6,270	8,065	9,742	11,517	14,161	18,429	19,308	20,997
Ohio	1,103	1,139	1,183	1,323	1,635	1,781	2,196	2,847	3,569	3,946	4,726
Indiana	403	453	469	541	723	1,054	(T)	(D)	1,944	1,815	1,988
Illinois	970	1,042	1,226	1,360	1,673	2,077	2,205	(D)	4,284	4,050	5,027
Michigan	2,016	1,961	2,249	2,750	3,614	4,272	5,501	5,975	7,415	8,468	8,116
Wisconsin	212	221	263	296	420	558	(T)	676	1,217	1,030	1,140
West North Central	1,052	1,005	1,184	1,507	1,948	2,950	3,155	3,840	5,795	5,307	4,298
Minnesota	411	403	551	602	802	1,180	1,746	(D)	2,242	2,066	1,810
Iowa	175	182	144	173	150	393	276	(D)	343	363	461
Missouri	399	350	398	630	746	1,137	(T)	(D)	1,905	2,380	(S)
North Dakota	(T)	(T)	(T)	(T)	(T)	(T)	(T)	10	60	(S)	(S)
South Dakota	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(S)	4	4	5
Nebraska	10	9	13	14	15	28	25	(D)	62	64	59
Kansas	51	60	76	84	216	211	282	(D)	1,179	404	(S)
South	2,891	2,964	3,442	3,691	4,496	6,987	8,943	12,020	16,656	15,320	15,471
South Atlantic	1,775	1,720	1,847	2,012	2,592	4,012	4,812	6,812	9,208	8,100	(S)
Delaware	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(D)	(D)	(D)	(D)
Maryland	481	446	452	382	424	(T)	(T)	1,437	1,350	1,088	1,203
District of Columbia	24	14	8	8	33	(T)	(T)	(D)	(D)	(D)	40
Virginia	244	236	254	318	464	539	906	800	1,342	1,126	1,115
West Virginia	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(D)	87	(D)	(D)
North Carolina	227	235	253	268	327	546	756	(D)	1,741	1,305	1,285
South Carolina	30	37	87	96	82	(T)	(T)	(D)	523	386	419
Georgia	83	81	91	99	147	220	335	(D)	1,001	719	868
Florida	374	348	398	462	620	1,449	(T)	1,832	2,133	2,341	(S)
East South Central	388	401	427	467	402	624	969	1,209	2,534	1,640	1,453
Kentucky	67	74	79	100	209	170	184	(D)	249	226	154
Tennessee	231	261	282	306	(T)	(T)	(T)	(D)	649	930	737
Alabama	79	57	56	48	62	100	180	(S)	1,592	428	521
Mississippi	8	10	10	13	(T)	(T)	(T)	62	44	56	(S)

See explanatory information and SOURCE at end of table.

Table A-45. Geographic distribution of total (company, Federal, and other) funds for industrial R&D performance in selected years

[Dollars in millions]

Page 2 of 2

Area	1974	1975	1976	1977	1979	1981	1983	1985	1987	1989	1991
West South Central	728	843	1,113	1,212	1,502	2,351	3,162	3,998	4,914	5,580	5,425
Arkansas	9	13	12	10	11	52	(T)	(D)	135	51	(S)
Louisiana	74	88	98	106	83	158	247	(D)	134	168	(S)
Oklahoma	76	99	116	142	174	339	392	(D)	384	332	392
Texas	567	643	887	954	1,233	(T)	(T)	3,492	4,261	5,028	4,755
West	5,620	6,165	6,855	7,379	10,176	11,873	17,173	23,738	27,387	30,859	(S)
Mountain	622	782	923	1,034	1,139	2,135	2,738	3,496	4,464	4,095	5,185
Montana	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(D)	7	(D)	(S)
Idaho	(T)	(T)	(T)	(T)	(T)	(T)	(T)	419	488	(D)	(S)
Wyoming	(T)	(T)	(T)	(T)	(T)	(T)	2	3	4	(D)	2
Colorado	166	194	250	257	269	529	713	917	1,261	1,162	(S)
New Mexico	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(D)	993	1,034	1,064
Arizona	199	243	203	200	372	758	(T)	1,002	845	917	944
Utah	61	91	112	132	142	265	233	(D)	809	387	356
Nevada	8	11	35	72	(T)	(T)	(T)	(S)	57	29	83
Pacific	4,958	5,384	5,932	6,345	9,037	9,738	14,435	20,242	22,923	26,764	(S)
Washington	484	499	610	631	(T)	(T)	(T)	2,183	3,071	2,716	3,215
Oregon	50	51	57	77	116	(T)	(T)	(D)	294	355	(S)
California	4,423	4,834	5,263	5,600	7,437	7,626	(T)	(S)	19,475	23,675	(S)
Alaska	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(D)	10	9	18
Hawaii	1	(T)	(T)	(T)	(T)	(T)	(T)	12	73	9	11
Undistributed funds	1,302	1,803	2,030	2,291	3,245	(T)	3,783	1,388	2,384	2,932	675

KEY: (D) = Data have been withheld to avoid disclosing information about individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.
(T) = Data are not separately available but included on total. See general notes.

NOTE: Though U.S. totals have been revised, data for individual States were not adjusted (see section A, Historical Data Revisions). The differences between revised data and those that were originally published were added to the "undistributed funds" categories.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-46. Geographic distribution of total (company, Federal, and other) funds for industrial R&D performance, by source of funds: 1991

[Dollars in millions]

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Area	Total	Federal	Company
United States	102,246	25,308	76,938
Northeast	30,748	6,486	24,262
New England	(S)	2,013	6,395
Maine	(S)	(D)	(D)
New Hampshire	(D)	(D)	102
Vermont	(D)	(D)	(D)
Massachusetts	(S)	1,480	4,855
Rhode Island	152	11	141
Connecticut	1,535	504	1,031
Middle Atlantic	22,340	4,473	17,867
New York	8,268	1,558	6,710
New Jersey	7,810	855	6,955
Pennsylvania	(S)	2,060	4,202
North Central	25,295	(S)	23,184
East North Central	20,997	1,307	19,690
Ohio	4,726	778	3,948
Indiana	1,988	226	1,762
Illinois	5,027	(S)	4,837
Michigan	8,116	(S)	8,027
Wisconsin	1,140	(S)	1,116
West North Central	4,298	(S)	3,494
Minnesota	1,810	150	1,660
Iowa	461	(D)	(D)
Missouri	(S)	(D)	(D)
North Dakota	(S)	(D)	(D)
South Dakota	5	0	5
Nebraska	59	7	52
Kansas	(S)	(D)	(D)
South	15,471	4,575	10,896
South Atlantic	(S)	2,520	6,073
Delaware	(D)	(D)	(D)
Maryland	1,203	666	537
District of Columbia	40	16	24
Virginia	1,115	679	436
West Virginia	(D)	(D)	69
North Carolina	1,285	4	1,281
South Carolina	419	(D)	(D)
Georgia	868	89	779
Florida	(S)	934	1,665
East South Central	1,453	637	816
Kentucky	154	(D)	(D)
Tennessee	737	(D)	(D)
Alabama	521	(S)	300
Mississippi	(S)	(D)	(D)
West South Central	5,425	(S)	4,007
Arkansas	(S)	(D)	(D)
Louisiana	(S)	16	156
Oklahoma	392	2	390
Texas	4,755	(D)	(D)
West	(S)	(S)	18,162
Mountain	5,185	2,156	3,029
Montana	(S)	(D)	(D)
Idaho	(S)	(D)	(D)
Wyoming	2	0	2
Colorado	(S)	(S)	1,751
New Mexico	1,064	1,001	63
Arizona	944	199	745
Utah	356	(S)	305
Nevada	83	63	20
Pacific	(S)	(S)	15,133
Washington	3,215	(D)	(D)
Oregon	(S)	28	321
California	(S)	(S)	12,368
Alaska	18	(D)	(D)
Hawaii	11	(D)	(D)
Undistributed funds	675	(S)	434

KEY (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-47. Distribution of total (company, Federal, and other) funds for industrial R&D performance, by industry and type of cost: 1991

[Dollars in millions]

Page 1 of 1

Industry	SIC code	R&D costs	Wages of R&D personnel	Materials and supplies	Overhead costs
			[Percent]		
Total		$102,246	41.6	17.6	40.7
Food, kindred, and tobacco products	20-21	1,360	50.8	12.8	36.4
Textiles and apparel	22-23	(D)	51.2	21.2	27.6
Lumber, wood products, and furniture	24-25	160	60.6	7.5	31.9
Paper and allied products	26	715	58.0	16.4	25.6
Chemicals and allied products	28	13,184	45.8	13.1	41.1
Industrial chemicals	281-82,286	4,433	42.0	14.1	43.9
Drugs and medicines	283	(D)	45.5	14.5	40.0
Other chemicals	284-85,287-89	(D)	52.6	8.2	39.1
Petroleum refining and extraction	13,29	2,245	41.0	13.3	45.7
Rubber products	30	(D)	46.4	19.1	34.5
Stone, clay, and glass products	32	(D)	43.7	19.0	37.4
Primary metals	33	836	45.7	16.5	37.8
Ferrous metals and products	331-32,3398-99	(D)	50.6	12.2	37.1
Nonferrous metals and products	333-36	(D)	43.7	18.3	38.1
Fabricated metal products	34	756	42.6	18.9	38.5
Machinery	35	15,089	43.9	13.3	42.8
Office, computing, and accounting machines	357	11,433	41.9	11.3	46.8
Other machinery, except electrical	351-56,358-59	3,656	49.9	19.7	30.4
Electrical equipment	36	17,280	40.7	17.5	41.8
Radio and TV receiving equipment	365	78	55.1	9.0	35.9
Communication equipment	366	10,444	38.6	17.9	43.5
Electronic components	367	5,321	45.0	17.5	37.5
Other electrical equipment	361-64,369	1,436	39.1	15.5	45.5
Transportation equipment	37	32,091	36.3	23.1	40.6
Motor vehicles and motor vehicles equipment	371	(D)	41.6	27.6	30.8
Other transportation equipment	373-75,379	(D)	53.4	16.1	30.5
Aircraft and missiles	372,376	21,692	33.6	21.1	45.3
Professional and scientific instruments	38	6,621	47.3	17.8	34.9
Scientific and mechanical measuring instruments	381-82	2,150	53.0	9.4	37.6
Optical, surgical, photographic, and other instruments	383-87	4,471	44.6	21.8	33.6
Other manufacturing industries	27,31,39	(D)	59.0	9.4	31.6
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9,642	43.4	14.6	42.0

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-48. Number of full-time-equivalent (FTE) R&D scientists and engineers in R&D-performing companies, by industry and size of company: 1982-92

[In thousands]

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Industry and size of company	SIC code	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Total (January)		509.8	540.9	584.1	622.5	671.0	695.8	708.6	720.2	730.9	704.1	683.7
Total (Annual average)		525.4	562.5	603.3	646.8	683.4	702.2	714.4	726.0	717.5	693.9	N/A
Distribution by industry:												
Food, kindred, and tobacco products 1/	20-21	7.4	7.7	7.4	(S)	(S)	(S)	(S)	(S)	8.8	9.4	9.8
Textiles and apparel	22-23	1.9	2.2	2.3	2.8	2.6	2.4	2.4	2.4	(S)	(S)	(S)
Lumber, wood products, and furniture	24-25	(T)	1.8	(T)	(S)	(S)	1.3	1.3	(S)	(S)	(S)	(S)
Paper and allied products	26	8.4	7.6	6.6	6.6	6.4	6.0	6.1	5.7	(S)	6.5	6.7
Chemicals and allied products	28	61.6	67.3	69.8	71.1	75.8	75.2	75.8	77.6	78.9	78.8	82.2
Industrial chemicals	281-82,286	25.9	26.6	25.6	23.5	24.9	(S)	(S)	(S)	(S)	(S)	(S)
Drugs and medicines	283	25.6	28.2	(T)	30.8	31.8	32.6	33.0	34.0	33.5	34.2	36.9
Other chemicals	284-85,287-89	10.1	12.1	13.4	16.7	19.1	20.2	20.3	20.5	22.4	21.9	23.9
Petroleum refining and extraction	13,29	15.6	14.7	13.3	13.5	10.4	9.9	9.5	10.3	10.2	10.0	9.7
Rubber products	30	8.1	(T)	(T)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Stone, clay, and glass products	32	5.1	5.5	5.6	6.6	7.5	8.6	8.6	8.5	8.6	8.3	8.1
Primary metals	33	8.4	8.3	8.4	7.1	5.7	5.5	5.6	5.7	(S)	(S)	(S)
Ferrous metals and products	331-32,3398-99	5.2	5.2	5.3	4.2	2.5	(S)	2.3	(S)	(S)	(S)	(S)
Nonferrous metals and products	333-36	3.2	3.0	3.1	2.9	3.2	3.4	3.3	3.3	3.4	(S)	(S)
Fabricated metal products	34	8.2	(T)	16.6	(S)	(S)	9.9	10.5	9.7	(S)	(S)	(S)
Machinery	35	76.0	79.6	87.0	81.7	89.7	95.8	98.4	99.8	112.3	107.2	95.4
Office, computing, and accounting machines	357	48.1	52.6	56.5	61.8	71.9	73.4	74.4	76.7	88.6	83.0	73.1
Other machinery, except electrical	351-56,358-59	27.9	27.0	30.5	19.9	17.8	22.4	24.0	23.1	23.7	24.2	(S)
Electrical equipment	36	109.8	108.6	113.2	113.2	117.9	130.4	132.5	140.6	138.0	137.7	144.6
Radio and TV receiving equipment	365	7.8	(T)	(T)	(S)	1.8	1.2	1.3	1.3	0.6	0.6	(S)
Communication equipment	366	45.9	48.8	59.3	62.2	65.0	71.9	73.1	72.8	74.2	70.6	77.3
Electronic components	367	24.4	25.6	(T)	29.2	(S)	43.7	44.3	(S)	48.5	51.3	(S)
Other electrical equipment	361-64,369	31.7	(T)	18.4	17.9	16.5	13.6	(S)	16.7	(S)	(S)	(S)
Transportation equipment	37	122.3	134.3	(T)	160.3	179.2	187.3	188.2	193.0	183.7	167.8	164.1
Motor vehicles and motor vehicles equipment	371	30.0	29.0	28.6	28.7	33.9	46.5	47.3	45.9	49.6	45.5	44.8
Other transportation equipment	373-75,379	1.2	2.2	(T)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Aircraft and missiles	372,376	91.1	103.1	111.5	130.2	144.8	136.3	136.4	142.3	128.5	117.9	115.4
Professional and scientific instruments	38	42.7	(T)	(T)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Scientific and mechanical measuring instruments	381-82	(T)	(T)	(T)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Optical, surgical, photographic, and other instruments	383-87	16.1	(T)	(T)	19.8	24.0	24.6	24.9	24.2	(S)	(S)	(S)

See explanatory information and SOURCE at end of table.

Table A-48. Number of full-time-equivalent (FTE) R&D scientists and engineers in R&D-performing companies, by industry and size of company: 1982-92

[In thousands]

Page 2 of 2

Industry and size of company	SIC code	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Distribution by industry:												
Other manufacturing industries 1/	27,31,39	5.5	5.9	(T)	(S)	(S)	6.3	6.4	5.4	(S)	(S)	(S)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	27.1	31.2	49.8	66.8	75.1	96.4	101.9	(S)	(S)	(S)	(S)
Distribution by size of company: [Number of employees]												
Fewer than 500 2/		40.7	52.7	81.9	78.3	(S)	105.2	109.0	(S)	(S)	(S)	(S)
500 to 999 3/		N/A	N/A	N/A	16.5	(S)	18.4	19.3	17.9	18.3	(S)	(S)
1,000 to 4,999		42.8	48.3	52.6	61.6	66.7	76.4	81.9	75.9	74.1	72.2	73.5
5,000 to 9,999		36.6	29.8	30.1	28.5	38.9	40.5	40.2	47.1	56.2	50.2	46.1
10,000 to 24,999		77.0	84.3	84.0	89.9	88.4	92.0	94.5	86.7	72.6	82.2	91.7
25,000 or more		312.7	325.8	335.5	347.6	365.3	363.3	365.2	387.5	397.3	371.7	357.9

1/ Until 1984, tobacco products (SIC 21) was included with "Other manufacturing industries."
2/ Data for 1981-83 are for companies with fewer than 1,000 employees.
3/ Until 1984, data were not broken down into this level of detail. See "Fewer than 500," above.

KEY: (S) = Data have been withheld because of imputation of more than 50 percent.
(T) = Data are not separately available, but are included in total.
N/A = Not available

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-49. Number of full-time-equivalent (FTE) R&D scientists and engineers in R&D performing companies, by industry and source of R&D funds: January 1992

[In thousands]

Page 1 of 1

Industry	SIC code	Total	Federal	Company
Total		683.7	(S)	(S)
Food, kindred, and tobacco products	20-21	9.8	0.0	(S)
Textiles and apparel	22-23	(S)	(D)	(D)
Lumber, wood products, and furniture	24-25	(S)	(D)	(D)
Paper and allied products	26	6.7	(D)	(D)
Chemicals and allied products	28	82.2	1.0	81.2
Industrial chemicals	281-82,286	(S)	(S)	(S)
Drugs and medicines	283	36.9	(D)	(D)
Other chemicals	284-85,287-89	23.9	(D)	(D)
Petroleum refining and extraction	13,29	9.7	(D)	(D)
Rubber products	30	(S)	(D)	(D)
Stone, clay, and glass products	32	8.1	(D)	(D)
Primary metals	33	(S)	1/	(S)
Ferrous metals and products	331-32,3398-99	(S)	(D)	(D)
Nonferrous metals and products	333-36	(S)	(D)	(D)
Fabricated metal products	34	(S)	(S)	(S)
Machinery	35	95.4	4.0	91.4
Office, computing, and accounting machines	357	73.1	3.6	69.5
Other machinery, except electrical	351-56,358-59	(S)	(S)	(S)
Electrical equipment	36	144.6	(S)	110.4
Radio and TV receiving equipment	365	(S)	0.0	(S)
Communication equipment	366	77.3	(S)	49.3
Electronic components	367	(S)	(S)	(S)
Other electrical equipment	361-64,369	(S)	(S)	(S)
Transportation equipment	37	164.1	82.9	81.2
Motor vehicles and motor vehicles equipment	371	44.8	(D)	(D)
Other transportation equipment	373-75,379	(S)	(D)	(D)
Aircraft and missiles	372,376	115.4	78.3	37.1
Professional and scientific instruments	38	(S)	(S)	(S)
Scientific and mechanical measuring instruments	381-82	(S)	(S)	(S)
Optical, surgical, photographic, and other instruments	383-87	(S)	(S)	(S)
Other manufacturing industries	27,31,39	(S)	(S)	(S)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	(S)	(S)	(S)

1/ Less than 0.5 thousand.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

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Table A-50. Cost per R&D scientist or engineer in R&D performing companies, by industry and size of company: 1981-91

Page 1 of 2

Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total		$103,900	$111,600	$116,000	$124,000	$130,200	$128,500	$131,200	$137,000	$140,600	$145,800	$147,400
Distribution by industry:												
Food, kindred, and tobacco products 1/	20-21	(D)	(D)	(D)	(D)	(D)	(D)	(S)	(D)	(D)	(D)	141,300
Textiles and apparel	22-23	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Lumber, wood products, and furniture	24-25	(S)	(S)	(S)	115,400	116,300	(S)	(S)	(D)	(S)	(S)	(S)
Paper and allied products	26	(D)	70,800	(D)	(D)	(D)	(D)	(D)	(D)	(S)	(S)	108,400
Chemicals and allied products	28	96,600	102,500	104,800	112,500	116,300	117,100	127,600	140,400	146,600	156,500	163,700
Industrial chemicals	281-82,286	118,000	122,100	123,100	132,000	144,600	150,200	(S)	(S)	(S)	(S)	(S)
Drugs and medicines	283	(D)	(D)	103,100	(D)	(D)	113,600	(D)	141,700	(D)	(D)	(D)
Other chemicals	284-85,287-89	(D)	(D)	(D)	(D)	(D)	83,100	(D)	101,300	(D)	(D)	(D)
Petroleum refining and extraction	13,29	(D)	(D)	(D)	(D)	(D)	(D)	195,600	196,400	201,600	209,900	227,400
Rubber products	30	(D)	(D)	75,400	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Stone, clay, and glass products	32	(D)	(D)	(D)	(D)	(D)	118,000	115,700	(D)	(D)	(D)	(D)
Primary metals	33	107,700	118,200	129,900	(D)	(D)	(D)	131,500	117,300	(S)	(D)	(S)
Ferrous metals and products	331-32,3398-99	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(S)	(D)	(D)	(D)
Nonferrous metals and products	333-36	(D)	(D)	(D)	112,000	136,400	138,800	(D)	(S)	(D)	(D)	(D)
Fabricated metal products	34	78,000	(S)	(S)	111,600	112,900	(S)	76,800	82,100	(S)	(S)	(S)
Machinery	35	93,900	103,800	108,400	124,500	142,500	(D)	(D)	(D)	138,400	134,000	149,000
Office, computing, and accounting machines	357	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other machinery, except electrical	351-56,358-59	(D)	(D)	(D)	(D)	(D)	119,200	104,700	115,500	(D)	(D)	(D)
Electrical equipment	36	95,300	100,000	114,300	121,700	124,900	120,700	120,600	118,900	121,600	128,500	122,500
Radio and TV receiving equipment	365	(D)	(D)	105,300	(D)	(D)	88,700	111,200	106,900	92,300	164,600	(S)
Communication equipment	366	105,500	123,300	135,000	143,000	147,800	141,300	140,500	141,100	140,800	148,700	141,200
Electronic components	367	66,700	69,600	(S)	100,500	114,100	(D)	97,400	(S)	(S)	108,800	(S)
Other electrical equipment	361-64,369	(D)	(D)	(D)	(D)	(D)	(D)	(S)	78,700	(S)	(S)	(S)
Transportation equipment	37	(D)	(D)	(D)	(D)	(D)	170,700	182,400	190,700	195,700	205,000	193,400
Motor vehicles and motor vehicles equipment	371	147,400	162,600	184,700	211,400	223,100	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	114,200	(D)	(D)	(S)	(S)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	128,400	148,800	143,600	156,000	161,700	149,800	179,400	185,900	189,400	205,900	185,900
Professional and scientific instruments	38	93,400	(S)	(S)	116,900	122,000	(S)	(S)	(S)	(S)	(S)	(S)
Scientific and mechanical measuring instruments	381-82	(D)	(D)	83,200	(D)	(D)	(D)	(D)	(S)	(S)	(S)	(S)
Optical, surgical, photographic, and other instruments	383-87	(D)	(D)	141,100	(D)	(D)	(D)	(D)	$150,400	(S)	(S)	(S)

See explanatory information and SOURCE at end of table.

Table A-50. Cost per R&D scientist or engineer in R&D performing companies, by industry and size of company: 1981-91

Page 2 of 2

Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Distribution by industry:												
Other manufacturing industries 1/	27,31,39	(D)	(D)	$98,500	(D)	(D)	(S)	(D)	(D)	(D)	(D)	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	$77,200	$84,800	82,400	$84,100	$94,600	$86,800	$79,100	$81,300	(S)	(S)	(S)
Distribution by size of company: [Number of employees]												
Fewer than 500 2/		58,600	62,800	65,700	55,000	(S)	70,600	74,300	65,800	70,000	(S)	(S)
500 to 999 3/		N/A	N/A	N/A	87,200	(S)	103,400	101,400	(S)	97,500	(S)	(S)
1,000 to 4,999		77,000	84,800	82,800	96,700	97,300	106,400	100,500	106,800	102,600	110,000	109,200
5,000 to 9,999		93,700	82,900	93,400	111,000	119,300	108,400	122,600	123,700	108,800	123,100	143,800
10,000 to 24,999		90,900	98,500	112,900	130,500	124,600	122,300	142,300	135,000	127,800	143,600	146,400
25,000 or more		117,200	128,900	134,200	143,000	155,300	154,300	163,100	172,200	175,700	177,000	170,900

1/ Until 1984, tobacco products (SIC 21) was included with "Other manufacturing industries."
2/ Data for 1981-83 are for companies with fewer than 1,000 employees.
3/ Until 1984, data were not broken down into this level of detail. See "Fewer than 500," above.

NOTE: The number of full-time-equivalent R&D scientists and engineers used to estimate the cost per R&D scientist or engineer is the arithmetic mean of the number of R&D scientists and engineers reported for January in two consecutive years. This number is then divided into the total R&D expenditures of the earlier years, and the ratio is attributed to the earlier year.

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.
N/A = Not available

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-51. Cost per R&D scientist or engineer, by industry and size of company: 1991

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Industry	SIC code	Total	Size of company [Number of employees]					
			Fewer than 500	500 to 999	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total		$147,400	(S)	(S)	$109,200	$143,800	$146,400	$170,900
Food, kindred, and tobacco products	20-21	141,300	(S)	(S)	110,600	121,000	133,400	154,500
Textiles and apparel	22-23	(D)	$48,700	(S)	115,200	(D)	158,100	(D)
Lumber, wood products, and furniture	24-25	(D)	(S)	(S)	110,600	154,300	256,200	(D)
Paper and allied products	26	108,400	(S)	(S)	83,400	47,100	126,700	110,000
Chemicals and allied products	28	163,700	63,900	$109,100	154,900	160,100	172,900	222,800
Industrial chemicals	281-82,286	(S)	(S)	136,000	169,000	187,100	173,400	(D)
Drugs and medicines	283	(D)	(S)	135,100	164,100	155,900	178,700	(D)
Other chemicals	284-85,287-89	(D)	61,500	(S)	143,300	119,600	(D)	(D)
Petroleum refining and extraction	13,29	227,400	46,200	(D)	125,700	291,900	258,200	234,400
Rubber products	30	(D)	(S)	(S)	116,800	(S)	(D)	(D)
Stone, clay, and glass products	32	(D)	(S)	(S)	62,700	(S)	130,800	(D)
Primary metals	33	(S)	(S)	(S)	126,800	(S)	140,100	(S)
Ferrous metals and products	331-32,3398-99	(D)	(S)	(S)	126,300	(S)	(D)	(D)
Nonferrous metals and products	333-36	(D)	(S)	(S)	127,100	(S)	134,400	(D)
Fabricated metal products	34	(S)	(S)	(S)	83,600	225,600	129,000	(D)
Machinery	35	149,000	124,600	113,100	115,100	156,500	113,900	169,900
Office, computing, and accounting machines	357	(D)	(S)	110,300	109,600	155,900	(D)	(D)
Other machinery, except electrical	351-56,358-59	(D)	213,800	115,800	120,000	(S)	113,800	(D)
Electrical Equipment	36	122,500	80,600	(S)	89,900	162,200	134,400	132,000
Radio and TV receiving equipment	365	(S)	(S)	(D)	(D)	(D)	0	0
Communication equipment	366	141,200	56,400	90,500	73,900	(D)	161,200	153,200
Electronic components	367	(S)	96,900	(S)	117,800	182,400	(S)	(D)
Other electrical equipment	361-64,369	(S)	(S)	(S)	71,200	(D)	126,500	(S)
Transportation equipment	37	193,400	(S)	(S)	111,700	(S)	167,300	198,100
Motor vehicles and motor vehicles equipment	371	(D)	(S)	(S)	81,600	(S)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(S)	(S)	(S)	(D)	92,100	0
Aircraft and missiles	372,376	185,900	(D)	(D)	121,800	100,800	250,200	186,000
Professional and scientific instruments	38	(S)	(S)	(S)	$97,000	(S)	$159,100	(D)
Scientific and mechanical measuring instruments	381-82	(S)	(S)	(S)	63,200	(D)	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	(S)	(S)	(S)	150,200	(S)	(D)	(D)
Other manufacturing industries	27,31,39	(D)	$77,800	(S)	81,900	(D)	125,300	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	(S)	(S)	(S)	109,200	$140,100	89,700	(S)

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

NOTE: The number of full-time-equivalent R&D scientists and engineers used to estimate the cost per R&D scientist or engineer is the arithmetic mean of the numbers of R&D scientists and engineers reported for January in two consecutive years. This number is then divided into the total R&D expenditures of the earlier years, and the ratio is attributed to the earlier year.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-52. Cost per R&D scientist or engineer in companies ranked by size of R&D program: 1981-91

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Companies ranked by size of R&D program	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
First 4 (1-4)	$160,200	$182,800	$185,200	$202,000	$225,800	$225,900	$222,600	$226,200	$218,100	$219,600	$215,000
Next 4 (5-8)	138,900	127,600	154,000	167,000	176,200	171,400	196,900	210,700	225,800	249,000	216,200
Next 12 (9-20)	107,000	127,500	119,300	127,800	132,500	131,200	141,600	153,000	148,700	129,100	102,100
Next 20 (21-40)	101,700	104,200	117,800	121,000	144,000	125,600	146,300	154,500	132,500	145,800	152,500
Next 60 (41-100)	96,400	98,000	118,800	130,400	124,100	139,000	128,700	141,300	145,400	164,200	169,100
Next 100 (101-200)	87,900	99,200	96,300	108,900	122,800	146,700	128,600	137,300	141,900	137,000	138,900
Next 200 (201-400)	79,900	86,900	86,400	97,300	94,100	138,000	110,800	124,500	106,100	120,200	127,500
Average of above 400 R&D performing companies	114,400	118,500	125,400	139,000	144,400	160,400	153,100	160,600	161,500	161,200	153,700

NOTE: The number of full-time-equivalent R&D scientists and engineers used to estimate the cost per R&D scientist or engineer is the arithmetic mean of the numbers of R&D scientists and engineers reported for January in 2 consecutive years. This number is then divided into the total R&D expenditures of the earlier years, and the ratio is attributed to the earlier year.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-53. Domestic employment of R&D-performing companies, by industry and size of company: 1990-91

Page 1 of 2

Industry	SIC code	Total	Size of company					
			Fewer than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
		[In thousands]						
		1990						
Total		16,888	(S)	(S)	2,179	1,466	2,747	8,592
Food, kindred, and tobacco products	20-21	1,310	(S)	(S)	(S)	123	196	861
Textiles and apparel	22-23	(S)	(S)	(S)	(S)	(D)	210	(D)
Lumber, wood products, and furniture	24-25	253	(S)	(D)	(S)	62	36	(D)
Paper and allied products	26	543	(S)	(S)	(S)	79	144	194
Chemicals and allied products	28	1,071	(S)	24	136	103	325	383
Industrial chemicals	281-82,286	400	(S)	6	32	57	98	202
Drugs and medicines	283	308	(S)	5	26	(D)	141	(D)
Other chemicals	284-85,287-89	363	(S)	(S)	79	(D)	85	(D)
Petroleum refining and extraction	13,29	410	(S)	(S)	30	34	67	266
Rubber products	30	(S)	(S)	(S)	(D)	51	60	(D)
Stone, clay, and glass products	32	297	(S)	(S)	(D)	21	94	(D)
Primary metals	33	430	(S)	(S)	102	78	86	121
Ferrous metals and products	331-32,3398-99	224	(S)	(S)	(S)	40	(D)	(D)
Nonferrous metals and products	333-36	206	(S)	(S)	49	38	(D)	(D)
Fabricated metal products	34	(S)	(S)	(D)	123	55	94	(D)
Machinery	35	1,361	(S)	(S)	262	192	171	459
Office, computing, and accounting machines	357	604	(S)	12	57	77	60	364
Other machinery, except electrical	351-56,358-59	757	(S)	(S)	205	114	111	95
Electrical equipment	36	1,890	(S)	72	220	92	281	1,015
Radio and TV receiving equipment	365	19	(S)	(D)	6	(D)	0	0
Communication equipment	366	924	39	(D)	33	(D)	112	717
Electronic components	367	452	(S)	(S)	75	43	63	161
Other electrical equipment	361-64,369	495	(S)	35	106	(S)	106	138
Transportation equipment	37	2,453	(S)	(D)	88	(D)	235	1,994
Motor vehicles and motor vehicles equipment	371	1,058	(D)	(D)	48	38	81	849
Other transportation equipment	373-75,379	114	(D)	(D)	16	(D)	76	0
Aircraft and missiles	372,376	1,281	(S)	(D)	24	29	77	1,145
Professional and scientific instruments	38	589	(S)	26	89	55	38	283
Scientific and mechanical measuring instruments	381-82	203	(S)	9	38	27	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	386	(S)	17	51	28	(D)	(D)
Other manufacturing industries	27,31,39	334	(S)	(D)	(S)	63	95	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	(S)	(S)	(S)	(S)	337	614	(S)

See explanatory information and SOURCE at end of table.

Table A-53. Domestic employment of R&D-performing companies, by industry and size of company: 1990-91

Industry	SIC code	Total	Size of company					
			Fewer than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
		[In thousands]						
		1991						
Total		16,071	(S)	(S)	2,107	1,340	2,631	8,159
Food, kindred, and tobacco products	20-21	1,317	(S)	(S)	(S)	126	191	876
Textiles and apparel	22-23	(S)	(S)	(S)	(S)	(D)	169	(D)
Lumber, wood products, and furniture	24-25	244	(S)	(D)	(S)	53	39	(D)
Paper and allied products	26	541	(S)	(S)	(S)	72	154	193
Chemicals and allied products	28	1,059	(S)	23	132	122	383	298
Industrial chemicals	281-82,286	391	(S)	7	38	52	121	169
Drugs and medicines	283	314	(D)	4	20	20	196	(D)
Other chemicals	284-85,287-89	354	(D)	(S)	75	50	66	(D)
Petroleum refining and extraction	13,29	410	(S)	(S)	28	23	76	269
Rubber products	30	(S)	(S)	(S)	(D)	34	43	(D)
Stone, clay, and glass products	32	272	(S)	(S)	(D)	29	81	(D)
Primary metals	33	422	(S)	(S)	(S)	75	87	114
Ferrous metals and products	331-32,3398-99	214	(S)	(S)	(S)	40	(D)	(D)
Nonferrous metals and products	333-36	208	(S)	(S)	50	36	(D)	(D)
Fabricated metal products	34	(S)	(S)	(D)	(S)	45	120	(D)
Machinery	35	1,202	(S)	55	273	137	140	397
Office, computing, and accounting machines	357	507	(D)	11	60	66	(D)	306
Other machinery, except electrical	351-56,358-59	695	(D)	44	212	71	(D)	90
Electrical equipment	36	1,819	(S)	72	200	71	286	1,001
Radio and TV receiving equipment	365	(S)	(S)	(D)	(S)	(D)	0	0
Communication equipment	366	921	39	(D)	30	(D)	110	721
Electronic components	367	401	(S)	(S)	71	38	59	144
Other electrical equipment	361-64,369	479	(S)	(D)	94	(D)	117	136
Transportation equipment	37	2,132	(S)	(D)	74	(D)	194	1,711
Motor vehicles and motor vehicles equipment	371	858	(S)	(S)	42	54	56	668
Other transportation equipment	373-75,379	103	(S)	(D)	(S)	(D)	66	0
Aircraft and missiles	372,376	1,171	(S)	(S)	(S)	28	72	1,042
Professional and scientific instruments	38	578	(S)	(S)	92	49	34	280
Scientific and mechanical measuring instruments	381-82	194	(S)	(S)	38	(D)	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	383	(S)	(S)	54	(D)	(D)	(D)
Other manufacturing industries	27,31,39	319	(S)	(D)	(S)	41	80	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	4,279	(S)	(S)	(S)	326	550	2,635

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-54. R&D scientists and engineers per 1,000 employees in manufacturing companies, by industry and size of company: 1981-91

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Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Distribution by industry:												
Total		29	33	34	40	43	45	45	47	49	50	50
Food, kindred,and tobacco products 1/	20-21	6	6	6	7	8	7	7	7	7	7	7
Textiles and apparel	22-23	3	4	4	5	5	4	4	(S)	4	4	4
Lumber, wood products, and furniture	24-25	(S)	(S)	(S)	6	6	5	5	5	5	5	5
Paper and allied products	26	16	14	12	13	13	11	11	11	11	12	12
Chemicals and allied products	28	44	51	54	57	57	70	68	70	72	74	76
Industrial chemicals	281-82,286	37	44	45	41	39	56	52	55	56	57	57
Drugs and medicines	283	66	74	(S)	89	81	98	98	99	98	110	113
Other chemicals	284-85,287-89	33	37	39	51	62	63	61	61	63	61	65
Petroleum refining and extraction	13,29	20	22	22	22	21	19	20	24	25	25	24
Rubber products	30	25	(S)	(S)	27	26	25	19	(S)	17	17	17
Stone, clay, and glass products	32	13	15	16	17	20	20	24	27	29	29	30
Primary metals	33	8	10	11	12	12	11	12	13	12	13	13
Ferrous metals and products	331-32,3398-99	6	8	11	11	11	7	9	9	9	10	10
Nonferrous metals and products	333-36	13	13	13	16	16	17	16	17	16	16	16
Fabricated metal products	34	15	(S)	(S)	(S)	(S)	(S)	17	17	18	18	17
Machinery	35	35	48	57	56	60	64	67	68	76	81	84
Office, computing, and accounting machines	357	71	80	88	90	99	107	115	116	133	142	154
Other machinery, except electrical	351-56,358-59	19	26	30	32	29	26	29	29	30	32	33
Electrical equipment	36	48	55	51	49	53	59	65	70	70	73	78
Radio and TV receiving equipment	365	51	(S)	(S)	(S)	23	55	45	48	45	29	28
Communication equipment	366	56	74	61	56	62	68	73	83	77	78	80
Electronic components	367	66	66	(S)	(S)	81	82	86	102	105	111	129
Other electrical equipment	361-64,369	34	(S)	(S)	30	30	26	28	26	26	30	31
Transportation equipment	37	N/A	N/A	N/A	(S)	71	69	68	73	73	72	78
Motor vehicles and motor vehicles equipment	371	30	31	30	27	28	38	42	41	43	45	53
Other transportation equipment	373-75,379	9	12	(S)	(S)	8	23	38	39	47	44	40
Aircraft and missiles	372,376	98	94	102	110	116	99	91	101	100	96	100
Distribution by industry:												
Professional and scientific instruments	38	46	(S)	(S)	(S)	(S)	(S)	71	70	76	72	69
Scientific and mechanical measuring instruments	381-82	(S)	(S)	(S)	(S)	(S)	(S)	85	94	106	107	104
Optical, surgical, photographic, and other instruments	383-87	47	(S)	(S)	(S)	70	61	63	58	60	54	51
Other manufacturing industries 1/	27,31,39	7	9	(S)	(S)	(S)	(S)	18	18	16	16	17

See explanatory information and SOURCE at end of table.

Table A-54. R&D scientists and engineers per 1,000 employees in manufacturing companies, by industry and size of company: 1981-91

Page 2 of 2

Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Distribution by industry:												
Professional and scientific instruments	38	46	(S)	(S)	(S)	(S)	(S)	71	70	76	72	69
Scientific and mechanical measuring instruments	381-82	(S)	(S)	(S)	(S)	(S)	(S)	85	94	106	107	104
Optical, surgical, photographic, and other instruments	383-87	47	(S)	(S)	(S)	70	61	63	58	60	54	51
Other manufacturing industries 1/	27,31,39	7	9	(S)	(S)	(S)	(S)	18	18	16	16	17
Distribution by size of company: [Number of employees]												
Fewer than 500 2/		28	30	34	42	50	59	59	58	59	59	56
500 to 999 3/		N/A	N/A	N/A	21	21	23	27	26	27	27	27
1,000 to 4,999		21	22	25	24	26	32	30	31	30	30	31
5,000 to 9,999		18	23	22	19	19	28	29	29	39	37	40
10,000 to 24,999		23	26	26	29	30	33	32	34	31	33	37
25,000 or more		36	43	42	47	49	56	57	58	62	66	73

1/ Until 1984, tobacco products (SIC 21) was included with "Other manufacturing industries."
2/ Data for 1981-83 are for companies with fewer than 1,000 employees.
3/ Until 1984, data were not broken down into this level of detail. See "Fewer than 500," above.

KEY: (S) = Data have been withheld because of imputation of more than 50 percent.
N/A = Not available

NOTE: The number of R&D scientists and engineers per 1,000 employees for 1991 is derived by dividing the arithmetic mean of scientists and engineers employed in January 1991 and January 1992 by the number of employees in all activities in March 1991. Similar procedures were used for earlier years. Nonmanufacturing industries are included in pre- 1983 calculations.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-55. R&D funds per employee, by size of company: 1981-91

Page 1 of 1

Size of company [Number of employees]	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
	Total (company, Federal, and other) R&D funds per employee										
Total	$3,010	$3,719	$4,163	$4,579	$5,148	$5,153	$5,338	$5,678	$6,122	$6,194	$6,362
Fewer than 500 1/	1,634	1,732	2,186	2,767	3,028	5,414	5,553	5,318	5,618	6,056	6,732
500 to 999 2/	N/A	N/A	N/A	2158	2,238	3,229	3,121	2,900	3,157	3,626	3,680
1,000 to 4,999	1,596	1,790	2,042	2,480	2,725	3,261	3,395	3,232	3,394	3,573	3,823
5,000 to 9,999	1,668	1,883	2,194	2,505	2,851	2,849	3,210	4,009	4,082	4,204	4,921
10,000 to 24,999	2,045	2,469	2,966	3,385	3,500	3,334	3,668	3,725	3,522	4,222	5,079
25,000 or more	4,193	5,502	5,785	6,184	7,071	6,878	7,035	7,547	8,027	8,014	7,783
	Company and other (except Federal) R&D funds per employee										
Total	2,059	2,534	2,814	3,095	3,383	3,503	3,562	3,804	4,140	4,381	4,787
Fewer than 500 1/	1,333	1,381	1,749	2,212	2,407	4,750	4,811	4,686	4,891	5,339	6,021
500 to 999 2/	N/A	N/A	N/A	1,782	1,700	2,997	2,859	2,657	2,968	3,369	3,228
1,000 to 4,999	1,311	1,503	1,687	2,096	2,316	2,725	2,799	2,740	2,931	3,133	3,381
5,000 to 9,999	1,323	1,551	1,613	2,199	2,409	2,316	2,682	3,309	3,493	4,013	4,805
10,000 to 24,999	1,675	2,025	2,351	2,689	2,769	2,697	2,969	3,139	3,095	3,617	4,422
25,000 or more	2,641	3,436	3,637	3,792	4,208	4,077	4,010	4,346	4,851	4,917	5,169

1/ Data for 1981-83 are for companies with fewer than 1,000 employees.
2/ Until 1984, data were not broken down into this level of detail. See "Fewer than 500," above.

NOTE: Averages were derived by dividing total and company R&D funds for a calendar year by employment data for March of that year.

KEY: N/A = Not available

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table A-56. Concentration of total employment in R&D-performing companies ranked by size of R&D program: 1985-1991

[Percent]

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Companies ranked by size of R&D program	1985	1986	1987	1988	1989	1990	1991
First 4 (1-4)	8	7	7	7	7	7	6
Next 4 (5-8)	4	4	4	3	3	3	3
Next 12 (9-20)	7	5	6	6	6	5	5
Next 20 (21-40)	7	6	6	5	4	5	4
Next 60 (41-100)	11	9	8	9	10	9	9
Next 100 (101-200)	12	7	7	8	8	8	9
Next 200 (201-400)	15	10	9	9	9	11	11
All others	36	52	53	53	53	52	53

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

SECTION B. TECHNICAL NOTES

Introduction

The Survey of Industrial Research and Development provides national estimates of the total expenditures on research and development (R&D) performed within the United States by industrial firms, whether U.S. or foreign owned. It is a sample survey in which all R&D-performing companies, including privately held firms, are intended to be included or represented. All companies that are identified as spending more than $1 million annually on R&D in the United States receive a survey form every year. Information from individual companies in the sample is used to develop national estimates on an industry-by-industry basis.

The National Science Foundation (NSF) has been sponsoring a survey of industrial R&D since 1953. The 1991 Survey of Research and Development in Industry is the 35th in the annual series sponsored by NSF and conducted by the Bureau of the Census. NSF's Division of Science Resources Studies monitors the survey. NSF also sponsored two industrial R&D surveys covering the 1953-56 period that were conducted by the U.S. Department of Labor, Bureau of Labor Statistics (BLS).[1] Data obtained in the earlier BLS surveys are not directly comparable with Census figures for 1957-91, because of methodological and other differences.

Respondents receive detailed definitions to help them determine which expenses to include or exclude from the R&D data they provide. Nevertheless, the statistics presented in this report are subject to response and concept errors caused by different respondent interpretations of the definitions of R&D activities and by variations in company accounting procedures. Consequently, the data are better indicators of changes in, rather than absolute levels of, R&D spending and personnel. Data quality has improved substantially since the early surveys were conducted, mainly because respondents have adopted more accurate and sophisticated accounting procedures over the years.

The survey's primary focus is on U.S. industry as a performer of, rather than as a source of funds for, R&D. Thus, data on Federal support of R&D activities performed by industry are collected and appear in several tables, but data on industrial funding of R&D undertaken at universities and colleges and other nonprofit organizations are not included in the major tables.[2]

The survey statistics provide (1) national estimates of total R&D performed by industry in the United States; (2) the portion of the effort that is financed by U.S. Government funds; and (3) the amount financed by the companies themselves or by other non-Federal sources such as State and local governments or other industrial firms. Also included are statistics on both the number of employees and the number of R&D-performing scientists and engineers at the firm, as well as on the domestic net sales for the company, and on the total funds for R&D financed by the domestic firm but performed outside the United States. The tables developed from the survey data are in section A, and copies of the 1991 survey questionnaire, instructions, and other survey documents are reproduced in section C.

The scope of the survey has been expanded and refined over the years in response to an increasing policy need for more detailed information on the nation's R&D effort. For example, questions on energy R&D were added in the early seventies, following the first oil-shortage crisis. On the other hand, the frequency of collection of certain data items has been reduced in an attempt to alleviate some of the respondent burden that has been placed on industry from all sources in recent years. Since the 1978 survey, a detailed questionnaire, Form RD-1, has been used only to collect data for odd-numbered years and an abbreviated version, Form RD-1A, containing only the most crucial data elements, has been used to collect data for the intervening, even-numbered years.

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[1] National Science Foundation, *Science and Engineering in American Industry.* Final Report on a 1953-54 Survey (NSF 56-16) and *Science and Engineering in American Industry*, 1956 (NSF 59-50) (Washington, DC:, 1956 and 1960).

[2] Data on industry funding of R&D performed at universities and colleges are collected in the annual Survey of Scientific and Engineering Expenditures at Universities and Colleges. More information about this survey is available from NSF's Science and Engineering Activities Program in the Division of Science Resources Studies (address is given in the General Notes preceding the detailed statistical tables).

Questions appearing only on the long form, request detail on: R&D by product field; company expenditures for R&D projects that were contracted to outside organizations, rather than performed in-house; Federal R&D support to the firm, by contracting agency; R&D expenditures by geographic area; and some detailed data on energy and pollution-abatement R&D activities. This report provides data collected from the long form.

SURVEY METHODOLOGY[3]

Overview

Data in the Survey of Industrial Research and Development are based on a sample of industrial firms, selected approximately every 5 years (e.g., 1976, 1981, 1987). In intervening years only a subset of the sample, or panel, receives annual survey forms and the Bureau of the Census makes estimates for the changes in R&D for the firms not canvassed annually. The sampling unit for this survey is the enterprise, or company, defined as a business organization consisting of one or more establishments under common ownership or control. The 1991 statistics in this publication are based on responses from a panel derived from the sample selected and first used for survey year 1987 (see table B-1).

The Standard Statistical Establishment List (SSEL), a Census compilation that contains information on 3.5 to 4.0 million establishments, was the universe used to construct the 1987 sample frame. Where necessary for multiestablishment companies, Census summed establishment-level data to the company level and then assigned a single Standard Industrial Classification (SIC) code to that firm—the SIC code of the establishment(s) having the highest dollar-value of payroll.[4] The frame from which the sample was drawn includes companies in all manufacturing industries and, on the basis of earlier samples, a select number of nonmanufacturing industries known to conduct R&D.

The weight given to an individual company is, in general, the inverse of the probability that the company would have been selected for inclusion in the sample. Certainty companies have a weight of 1.00. The company weight is retained both in the sampling year and in the years between samples. To minimize respondent burden, only the panel subset of the sample is canvassed between sample years. Most small firms are not re-contacted, but, in each succeeding year, Census estimates the data for each noncanvassed firm on the basis of the changes in the initial value of the R&D reported by the firm and the average growth rate for the firm's industry.

Frame Creation

In constructing a frame from which to draw a sample of R&D-performing industries, NSF staff, given a finite budget for sample selection, make certain assumptions about industries to maximize sampling efficiency. That is, they apply *a priori* knowledge of industrial R&D activity to eliminate some industries from the possibility of selection by the initial SSEL sort and to designate other companies for sampling with 100-percent certainty. In addition, NSF staff made several innovations for the sample drawn in 1987 to improve its quality.

As in previous sample years, all companies that had been on the previous panel received a survey form. In addition, Census staff reviewed lists of R&D contractors published by the Department of Defense (DoD) and the National Aeronautics and Space Administration (NASA) to ensure that all their large industrial R&D-performing contractors were included in the sample with certainty.

From the outset, a major goal was to eliminate from the sampling frame to the greatest extent possible companies unlikely to have R&D programs. These companies were eliminated to minimize the number of sample companies chosen that had no R&D activity. To accomplish this objective, two steps were taken:

1. NSF staff narrowed the list of nonmanufacturing industries considered in-scope by eliminating those likely to engage in little or no R&D activity. Thus, companies in the eliminated nonmanufacturing industries had no chance of being selected. This method gave companies in the manufacturing industries and the remaining nonmanufacturing industries a greater probability of selection.

2. Companies with more than 500 employees in the in-scope industries were sampled with certainty. Companies with less than 500 employees were subjected to or eliminated from sampling on the basis of varying employment size level cutoffs. An assumption was made that in some industries companies with only a small number of employees are unlikely to engage in

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[3] The information presented in this section was provided by the Industry Division of the Bureau of the Census, the collecting and compiling agent for the National Science Foundation.

[4] Executive Office of the President, Office of Management and Budget, Standard Industrial Classification Manual, 1972 (Washington, DC, Supt. of Documents, U.S. Government Printing Office).

Table B-1. Number of companies in the universe, sample, and 1991 panel

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Industry	SIC code	Universe	Selected for 1987 sample	Certainties	Companies with data for 1987	1991 RD-1 panel
Total		154,476	13,917	7,998	3,648	1,648
MANUFACTURING						
Total		64,237	6,656	4,090	2,875	1,365
Distribution by industry:						
Food, kindred, and tobacco products	20-21	762	421	410	139	62
Textiles and apparel	22-23	2,582	466	446	117	39
Lumber, wood products, and furniture	24-25	1,518	234	213	93	36
Paper and allied products	26	1,103	172	144	81	37
Chemicals and allied products	28	6,630	315	242	200	142
Industrial chemicals	281-82,286	1,048	89	83	56	46
Drugs and medicines	283	854	69	60	46	35
Other chemicals	284-85,287-89	4,728	157	99	98	61
Oil and gas extraction	13	566	113	94	13	26
Petroleum refining and related industries	29	1/	1/	1/	24	1/
Rubber products	30	2,086	188	164	109	37
Stone, clay, and glass products	32	1,306	179	123	70	25
Primary metals	33	2,254	305	195	115	50
Ferrous metals and products	331-32,3398-99	1,188	144	116	52	23
Nonferrous metals and products	333-36	1,066	161	79	63	27
Fabricated metal products	34	10,046	503	276	210	59
Machinery	35	11,741	1,329	475	588	279
Office, computing, and accounting machines	357	1,707	150	136	121	93
Other machinery, except electrical	351-56,358-59	10,034	1,179	339	467	186
Electrical equipment	36	12,182	1,234	501	577	267
Radio and TV receiving equipment	365	650	58	24	17	5
Communication equipment	366	1,900	138	119	84	70
Electronic components	367	4,574	329	140	165	98
Other electrical equipment	361-64,369	5,058	709	218	311	94
Transportation equipment	37	498	289	211	156	127
Motor vehicles and motor vehicles equipment	371	159	99	98	64	37
Other transportation equipment	373-75,379	253	133	56	45	14
Aircraft and missiles	372,376	86	57	57	47	76
Professional and scientific instruments	38	5,800	453	180	274	139
Scientific and mechanical measuring instruments	381-82	2,363	268	87	160	72
Optical, surgical, photographic, and other instruments	383-87	3,437	185	93	114	67
Other manufacturing industries	27,31,39	5,163	455	416	109	40

See explanatory information and SOURCE at end of table.

Table B-1. Number of companies in the universe, sample, and 1991 panel

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Industry	SIC code	Universe	Selected for 1987 sample	Certainties	Companies with data for 1987	1991 RD-1 panel
NONMANUFACTURING						
Total		90,239	7,261	3,908	769	283
	10	23	22	22	10	5
	11	72	25	25	4	0
	14	79	30	10	10	4
	15	3,157	185	150	11	2
	16	1,963	140	89	11	4
	17	433	139	129	11	1
	40	27	21	21	5	3
	41	96	41	29	0	0
	42	314	142	141	3	2
	44	88	54	50	3	0
	45	112	65	63	3	2
	46	19	12	8	1	0
	47	77	42	33	1	1
	48	2,860	115	88	23	18
	49	774	222	183	94	38
	50	665	274	270	40	20
	51	2/	2/	2/	3	1
	53	219	156	156	3	3
	54	594	309	307	10	2
	56	255	132	132	6	0
	60	387	387	387	7	0
	62	145	82	79	4	1
	63	854	592	590	19	5
	72	75	34	33	5	1
	73	3,541	329	303	35	25
	737 7391	16,302	475	108	133	59
	7392 7397	4,532	605	168	89	38
	78	98	24	21	4	0
	806	23	23	23	2	0
	807	10,318	1,118	161	60	11
	891	42,137	1,466	129	159	37

1/ Data for "Oil and gas extraction" and "Petroleum refining and related industries" have been combined and are shown under "Oil and gas extraction."

2/ Data for SICs 50 and 51 have been combined and are shown under SIC 50.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

R&D activity, and an employment cutoff was set for each industry group. Generally, the cutoff was 250 employees with some exceptions (e.g., the cutoff for hospitals was 1,000 employees). Those companies falling below the cutoff were eliminated from the universe frame.

To improve coverage of R&D-performing companies, NSF staff in 1987 provided to Census the names of firms, identified through media reports or other sources as R&D performers, that were to be included in the sample with certainty. Most of these companies, because they met other established criteria, would have received questionnaires anyway, but a few were added to the sample by this effort. All certainty companies—those on lists provided by NSF staff, on lists of DoD and NASA contractors, companies with more than 500 employees, and previous panel members—are self representing, i.e., they have sampling weights of one.

Based on (1) SIC code, (2) total employment cutoffs, (3) inclusion on an NSF, DoD, or NASA list, or (4) previous panel membership, approximately 154,000 companies were identified as in-scope of the survey and, therefore were included in the sampling frame. The new efforts to improve targeted coverage resulted in a sharp reduction in the size of the total in-scope universe from about 450,000 companies in 1981.

It is likely that a small number of companies engaged in R&D activity were omitted from the sampling frame as a result of these sample selection operations. It was agreed, however, that the benefit from the new operations—greater sampling efficiency, resulting in improved national estimates of industrial R&D expenditures and employment—far outweighed the cost of the loss of a few companies that may have been eliminated from the in-scope sampling frame.

Probability Proportionate to Size

As with most types of economic surveys, the sample selection process used probabilities proportionate to size. That is, large companies had a proportionately higher probability of selection than did small companies, where large or small was measured relative to the statistic being estimated.

It would have been ideal if size could be determined by the amount of a company's R&D expenditures. Unfortunately, except for the companies that were in the current panel, it was impossible for Census to know the R&D expenditure values for firms in the universe frame. One logical solution was to estimate each company's R&D expenditures and base the probability of selection on the estimated values. This strategy had been employed in the 1981 sampling operation.

Clearly, this strategy has weaknesses. Even with the reduced number of in-scope industries in the sampling frame, many companies chosen for the frame may not have engaged in any R&D activity. Nevertheless, the procedure used to estimate the size of companies treated all companies as if they did in fact perform R&D.

Census estimated the size of each company's R&D expenditures by using a relationship linking the size of each company's employment to its amount of R&D expenditures. [Since company employment was known for the universe, it was possible to use this relationship to estimate R&D expenditures values for all companies in the 1987 sampling frame. Census derived this relationship for each SIC classification category, using data collected in the then most recent (1985) survey cycle]. Rather than treating all companies equally, the larger the number of employees in a company, the higher the probability of selection for inclusion in the sample. It was deemed reasonable to assume that large companies were more likely to have R&D programs than were small companies.

One further adjustment was introduced to the sample selection process. This was based on the assumption that multiestablishment companies, on average, would be expected to perform more R&D than single-establishment companies of the same size and in the same industry. The 1985 panel data were used to develop this adjustment factor. It should be noted that, for companies that were in the previous panel, the actual reported R&D activity was used and the data were not adjusted.

Sample Allocation and Relative Standard Error Constraints

The sampling program utilized for this operation allowed parameters to be assigned permitting the sample to be allocated across various levels, or strata, that corresponded to industry groupings. This procedure permitted a desired sample size, or a desired sampling error, to be achieved for each stratum. Estimated errors of total R&D estimates for these strata were not to exceed certain levels. Since the amount of funds provided by NSF determined the size of the sample to be drawn, the only constraint in achieving these results was that the total sample size across all the strata could not exceed 12,000-13,000 companies. NSF staff provided relative rankings for each industry group—high, medium, or low—to determine the precision of the estimate. An actual translation to what high, medium, or low meant, specifically, could not be determined until Census staff arbitrarily investigated several sampling error levels, computed the sample size that these levels implied, and applied the constraint of the total sample size of 13,000. The result of this investigation led to the following criteria for the target sampling error of estimate of funds for R&D performance:

a. High precision:	sampling error not to exceed 2 percent
b. Medium precision:	sampling error not to exceed 5 percent
c. Low precision:	sampling error not to exceed 10 percent

Based on the desired precision, these criteria suggested a total sample size of approximately 13,500. This number was not excessively beyond the stated limit of 13,000, so this sample size parameter was chosen for the selection process.

One limitation should be noted. Sampling errors were controlled by using a universe total that, in large part, was improvised; that is, and as previously noted, Census assigned an R&D value to every company in the frame, even though many of these companies may not actually have had R&D expenditures. The value assigned was imputed for the great majority of companies in the frame, and, as a consequence, the estimated universe and the distribution of individual company values did not necessarily reflect reality. Estimates of sampling variability were nevertheless based on this distribution. The presumption was—and this had been confirmed in the previous sample selection—that actual variation in the sample design would be less than that estimated, because many of the sampled companies have true R&D values of zero, not the widely varying values that were imputed using total employment as a predictor of R&D. Thus, the 2-percent, 5-percent, and 10-percent error levels described earlier are conservative. (See table B-2 for a complete list of the actual standard errors in the 1991 survey.)

The particular sample selected was one of a large number of the same type and size that, by chance, might have been selected. Estimates from each of the different samples would differ somewhat from each other and from the results of a complete canvass conducted under essentially the same conditions as the survey. In addition to sampling error the estimates are subject to nonsampling error that would also occur if a complete canvass were to be conducted under the same conditions.

Sample Selection

The sample selection program was run with a specified expected sample size of 13,500 and with other parameters set to ensure compliance with the relative standard error constraints. An actual sample of 13,917 was selected. The actual sample size differs from the specified sample for two reasons. First, the selection program used independent sampling. Each company had an independent chance of selection, based on its assigned probability; the selection of a company was completely independent of the selection of any other company. In independent sampling, sample size itself is a random variable. Theoretically, a sample of size zero or a sample the size of the entire universe is possible, but the probabilities of these extremes are so small that these are nearly impossible situations. The actual sample size is usually quite close to the specified size. If there is too much deviation, the program is simply executed again.

Second, a minimum probability rule was imposed. As noted earlier, the sampling program assigns probabilities proportionate to size (where size in this case is the imputed R&D value assigned each company). Selected companies that have R&D programs vastly larger than their assigned values can have adverse

Table B-2. Standard error of estimate (percentage) of total (company, Federal, and other) funds for industrial R&D performance for all company size groups and for companies with fewer than 1,000 employees, by industry: 1991

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Industry	SIC code	Standard error 1/	Standard error of companies with fewer than 1,000 employees
Total		0.8	7.0
Food, kindred, and tobacco products	20-21	0.0	0.0
Textiles and apparel	22-23	8.2	37.1
Lumber, wood products, and furniture	24-25	0.6	6.6
Paper and allied products	26	4.5	42.9
Chemicals and allied products	28	2.9	42.8
Industrial chemicals	281-82,286	0.7	28.2
Drugs and medicines	283	0.7	32.2
Other chemicals	284-85,287-89	14.4	57.3
Petroleum refining and extraction	13,29	0.2	25.5
Rubber products	30	2.0	22.5
Stone, clay, and glass products	32	0.8	30.2
Primary metals	33	1.4	33.4
Ferrous metals and products	331-32,3398-99	4.5	53.6
Nonferrous metals and products	333-36	0.4	14.5
Fabricated metal products	34	5.1	21.5
Machinery	35	2.9	18.4
Office, computing, and accounting machines	357	3.7	48.1
Other machinery, except electrical	351-56,358-59	3.1	7.0
Electrical equipment	36	1.7	14.6
Radio and TV receiving equipment	365	9.3	27.2
Communication equipment	366	1.3	32.5
Electronic components	367	4.7	22.1
Other electrical equipment	361-64,369	5.8	18.2
Transportation equipment	37	0.1	30.0
Motor vehicles and motor vehicles equipment	371	0.4	70.0
Other transportation equipment	373-75,379	1.9	23.7
Aircraft and missiles	372,376	0.0	0.0
Professional and scientific instruments	38	1.2	9.4
Scientific and mechanical measuring instruments	381-82	2.3	10.3
Optical, surgical, photographic, and other instruments	383-87	1.4	16.9
Other manufacturing industries	27,31,39	1.9	11.0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	4.1	9.0

1/ A description of the standard error of estimate is given in section A under "Methodology of Survey." The percentage (or relative) standard errors in this table may be converted to standard errors of estimate by multiplying the percentages shown by the associated estimates. For example, the relative standard error of estimate for R&D performance for all company size groups in the chemicals industry (SIC 28) is shown as 2.9 percent and the associated total R&D estimate for this industry is shown as $13,183 million in table A-3, "Total (company, Federal, and other) funds for industrial R&D performance, by industry and size of company: 1981-91." The standard error of estimate, then, is 0.029 times 13183, or 382.3

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

effects on the final statistics. To lessen these effects, the maximum weight a company can assume was arbitrarily controlled by specifying that the probability of selection could not be less than a certain value. If the probability, based on its size, is less than this minimum value, then it is set equal to this value. The consequence of raising these original probabilities to the minimum probability is to raise the expected sample size. It is likely that most of the difference between the specified sample size and the actual sample size is because of the application of the minimum probability rule.

Annual Panel

The panel is a group of companies that receive a survey questionnaire, Form RD-1, annually. The following is a description of how the present panel was formed from the 1987 sample.

The basic tool for the survey is Form RD-1, which is used to collect detailed R&D information. The 1,095 companies that were in the old panel and had received a 1986 Form RD-1 received a Form RD-1 for 1987. The remaining certainty companies (6,903) and other companies (5,919) in the new sample received a Form RD-1A for 1987. Form RD-1A is an abbreviated version of RD-1 and generally is mailed to companies only in the year in which a new sample is drawn. The purpose is to canvass smaller R&D performers but to impose a minimum reporting burden on them.

Of the 13,917 companies that received a survey questionnaire (either form) in 1987, 3,648 respondents reported that their companies were R&D performers or were identified as R&D performers based on information from other sources. The 3,648 companies were ranked by total R&D funds (both Federal and company and other) within each SIC code. All companies with over $1 million in total R&D expenditures were placed on the RD-1 panel. In some industries Census added to the panel companies with less than $1 million in R&D expenditures in an attempt to ensure 95-percent coverage of the R&D total for each industry.

The result of this process was an increase of panel size from 1,095 companies based on the previous sample to 1,742 companies based on the sample drawn in 1987. All companies selected for the panel will receive the RD-1 questionnaire annually until the next sample is drawn (for 1992). The other companies will not receive another questionnaire; their R&D data will be estimated in subsequent years by Census staff, using the companies' 1987 reports as a base.

Followup for Survey Nonresponse

The 1991 survey questionnaires were mailed in March 1992, and recipients were asked to respond within 60 days. Thirty days later, letters were mailed to all survey recipients, reminding them that their completed questionnaire was due within the next 30 days. At 60 days, an initial set of followup letters was sent to all nonresponding firms. Two additional followup mailings were made to persistent nonrespondents, at 90 and 120 days. The 90-day followup mailing included a replacement questionnaire.

In addition to the followup mailings, telephone followup was used to encourage response from those nonresponding firms ranked among the 200 largest R&D performers, based on 1989 expenditures. Telephone followup was also used for these firms during the initial data edit phase of survey operations.

Imputation for Item Nonresponse

Even when forms are returned, they are often incomplete. Many firms choose to return the survey forms with one or more items blank, for various reasons—for instance, the internal accounting procedures of the firm may not allow it to quantify R&D by pollution-abatement expenditures. In addition, some firms, as a matter of policy, refuse to answer any voluntary questions. Four data items on the questionnaires (total R&D expenditures, Federal R&D funds, net sales, and total employment), however, are included in Census' mandatory statistical program. The response rate for these mandatory items was significantly higher than for the other items on the survey.

When respondents do not provide the requested information, Census estimates the missing data for each firm, using imputation algorithms. In general, the imputation algorithms employed by Census compute values for missing items by applying the average percentage change for the target item in the nonresponding firm's industry to the item's prior-year value for that firm, reported or imputed. This approach, with minor variation, is used for most items on the survey form. Note that all items for nonpanel firms—that is, firms that are surveyed in the sample year, but that, because of size, are not surveyed again until a new sample is selected—are estimated in the nonsample years, using these imputation processes.

Table B-3 contains imputation rates for the principal survey items. For a detailed discussion of the problems stemming from item nonresponse, see the NSF technical report, *Estimating Basic and Applied Research and Development in Industry: A Preliminary Review of Survey Procedures*, NSF 90-322.

There are two survey items that do not use this general imputation methodology: (1) geographic distribution of R&D expenditures and (2) R&D expenditures distributed by basic research, applied research, and development (character of work). The imputation method for computing estimates of the geographic distribution of R&D expenditures was revised in 1989 to include the use of secondary source information as well as focused telephone followup. The secondary source used is the *Directory of American Research and Technology 1991* (R.R. Bowker, New York) which lists the locations of R&D laboratories for over 6,700 firms in the U.S. R&D expenditures for nonresponding firms listed in this directory as having a laboratory in only a single State were assigned to that State. The remaining nonresponding firms were contacted by telephone and asked to distribute their reported R&D expenditures. Most were able to provide this information. This modified approach is used only for nonresponding firms ranked among the 200 largest R&D performers. The imputation rates listed in table B-3 reflect gains made using this method.

The imputation procedure used for the basic research, applied research, and development expenditure estimates was revised in 1987 for use with 1986 and later data and also differs from the general imputation approach. Response to character-of-work items has been declining in recent years and, as a result, imputation rates have been increasing. The general imputation procedure became increasingly dependent upon information that had been imputed in prior years, thereby distancing current-year distribution estimates from the time they were reported. In addition, to reduce the reporting burden of this survey, smaller, nonpanel firms in the sample have never been asked to disaggregate their R&D expenditures into character-of-work categories; consequently, imputation is required for all such firms.

Because of the increasing dependence on imputed data, NSF chose not to publish estimates of industrial basic research, applied research, and development in this report series beginning in 1986. In 1987, Census revised its approach for imputing character-of-work estimates. The revised method calculates the character-of-work distribution for a nonresponding firm only if that firm reported a distribution within a 5-year time period, extending from 2 years before to 2 years after the year requiring imputation. Imputation for a given year is initially performed in the year the data are collected and is based on a character-of-work distribution reported in either of the 2 previous years, if any. It is again performed using new data collected in the next 2 years. Thus, character-of-work estimates are revised as newly reported information becomes available and are not final for 2 years following their initial publication. This revised imputation procedure was first used for the 1986 estimates.

If reported data are not available for a firm, Census does not impute a character-of-work distribution for that firm. As a consequence of this restriction, only approximately 70 percent of the total estimated R&D expenditures were distributed across these categories in the 1986 Census estimates. Those expenditures not meeting the requirements of the new imputation methodology were placed in the newly created "not distributed" category. Tables B-4 through B-6 show the current character-of-work estimates provided by Census along with the "not distributed" component for 1989, 1990, and 1991, respectively.

However, NSF's objective in this survey is to provide estimates for the entire population of firms performing R&D in the United States. Because the revised Census imputation procedure no longer produces such estimates because of the "not distributed" component, this objective was not being met for character-of-work estimates. A separate NSF technical report, *Estimating Basic and Applied Research and Development in Industry: A Preliminary Review of Survey Procedures*, NSF 90-322, presents character-of-work estimates for 1986, 1987, and 1988 and examines several alternative approaches to apportioning the "not distributed" data to the basic research, applied research, and development categories. The tables in the report illustrate how estimated figures for basic research, applied research, and development can vary, depending on assumptions made about the R&D expenditures that are not distributed. The 1989, 1990, and 1991 estimates of basic research, applied research, and development provided in section A of this report were calculated using the baseline estimation method presented in NSF 90-322. In the baseline estimation method, the "not distributed" expenditure data are allocated, by industry group, to basic research, applied research, and development categories, using the percentage splits in the distributed category for that industry. The allocation is done at the lowest level of published industry detail only; higher levels are derived by aggregation.

Table B-3. Imputation rates for selected items, by industry: 1991

[Percent]

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Industry	SIC code	Net sales	Total employment	R&D scientists/ engineers	Total R&D		
					Total	Company	Federal
Total		22.8	30.5	46.9	7.0	12.3	2.7
Food, kindred, and tobacco products	20-21	25.6	19.4	47.1	9.3	12.4	1/
Textiles and apparel	22-23	51.4	58.8	68.8	31.1	43.1	0.0
Lumber, wood products, and furniture	24-25	32.6	41.1	68.7	12.7	20.1	1/
Paper and allied products	26	22.4	32.1	48.4	15.0	20.6	1/
Chemicals and allied products	28	7.1	12.0	35.4	4.8	7.2	19.8
Industrial chemicals	281-82,286	4.4	4.4	61.7	6.9	7.1	20.5
Drugs and medicines	283	4.5	5.9	29.7	1.3	6.0	26.3
Other chemicals	284-85,287-89	12.4	25.7	20.6	9.6	10.2	0.0
Petroleum refining and extraction	13,29	6.4	7.5	39.1	0.7	0.7	0.0
Rubber products	30	27.5	51.9	73.4	13.2	17.8	0.0
Stone, clay, and glass products	32	24.2	22.6	19.7	2.9	3.9	0.1
Primary metals	33	29.8	35.0	60.5	7.3	20.3	7.2
Ferrous metals and products	331-32,3398-99	32.5	41.4	75.4	10.6	35.7	72.8
Nonferrous metals and products	333-36	26.5	28.4	51.2	5.9	13.8	5.7
Fabricated metal products	34	58.0	57.6	65.7	17.2	39.4	18.8
Machinery	35	22.4	25.4	27.5	8.0	11.9	3.3
Office, computing, and accounting machines	357	4.7	7.3	19.6	4.7	7.9	0.1
Other machinery, except electrical	351-56,358-59	35.6	38.5	53.4	18.2	24.2	22.4
Electrical equipment	36	10.9	14.0	50.0	7.6	17.0	3.0
Radio and TV receiving equipment	365	97.1	95.6	92.3	40.7	92.6	1/
Communication equipment	366	3.1	4.2	38.1	1.4	11.8	0.0
Electronic components	367	15.3	21.3	60.8	15.5	19.8	22.9
Other electrical equipment	361-64,369	21.3	23.5	72.7	20.7	26.3	37.7
Transportation equipment	37	6.3	9.2	30.2	0.9	2.0	0.1
Motor vehicles and motor vehicles equipment	371	8.6	16.2	40.1	1.5	2.0	0.4
Other transportation equipment	373-75,379	24.0	29.3	84.4	6.6	8.8	0.0
Aircraft and missiles	372,376	2.0	2.3	24.5	0.4	1.7	0.0
Professional and scientific instruments	38	15.4	20.6	92.1	9.2	11.5	8.4
Scientific and mechanical measuring instruments	381-82	21.0	28.7	79.6	11.3	17.3	0.0
Optical, surgical, photographic, and other instruments	383-87	13.3	16.6	95.4	8.2	8.6	2.2
Other manufacturing industries	21,27,31,39	34.5	35.6	59.4	8.9	10.2	0.0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	40.9	51.1	54.4	25.6	37.6	15.5

See explanatory information and SOURCE at end of table.

Table B-3. Imputation rates for selected items, by industry: 1991

[Percent]

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Industry	SIC code	R&D by cost			R&D by State	Energy R&D	Pollution abatement	R&D outside company	Foreign R&D
		Wages	Materials	Other costs					
Total		49.6	48.1	47.9	44.2	45.9	56.1	13.8	8.8
Food, kindred, and tobacco products	20-21	42.4	43.6	42.0	39.7	15.4	4.2	9.2	2.8
Textiles and apparel	22-23	76.1	62.9	81.1	73.3	0.0	33.8	0.0	75.9
Lumber, wood products, and furniture	24-25	36.0	43.0	34.9	57.1	92.3	5.2	91.0	92.9
Paper and allied products	26	71.9	69.8	71.0	71.4	5.9	11.6	7.1	9.3
Chemicals and allied products	28	46.6	49.8	48.7	51.9	87.8	62.6	7.0	1.4
Industrial chemicals	281-82,286	60.4	59.7	60.7	85.8	88.2	54.7	13.8	2.3
Drugs and medicines	283	47.5	47.0	47.6	37.7	0.0	3.7	8.1	1.6
Other chemicals	284-85,287-89	26.4	32.3	28.6	27.9	13.3	80.8	0.2	0.2
Petroleum refining and extraction	13,29	39.4	38.8	39.3	33.0	29.8	6.0	1.2	0.0
Rubber products	30	54.5	49.5	58.3	53.0	22.9	9.8	4.8	29.1
Stone, clay, and glass products	32	19.3	18.6	18.5	15.7	0.0	0.0	0.9	1.2
Primary metals	33	70.5	69.2	67.0	67.3	8.7	92.8	11.2	46.0
Ferrous metals and products	331-32,3398-99	60.3	60.6	60.3	53.4	8.8	67.5	45.8	0.0
Nonferrous metals and products	333-36	75.3	71.7	69.7	72.5	8.1	93.6	3.4	46.3
Fabricated metal products	34	57.1	55.6	53.1	54.5	67.5	74.2	49.7	67.2
Machinery	35	36.8	29.7	27.5	31.3	47.6	59.2	24.9	14.0
Office, computing, and accounting machines	357	33.8	24.1	24.0	28.2	1/	0.0	26.7	13.5
Other machinery, except electrical	351-56,358-59	44.8	39.7	43.9	41.0	47.6	60.1	9.7	17.3
Electrical equipment	36	56.7	55.2	54.9	40.3	30.6	25.8	42.3	48.3
Radio and TV receiving equipment	365	96.1	97.9	97.0	96.6	1/	1/	1/	0.0
Communication equipment	366	46.1	45.5	45.8	31.6	13.5	21.1	35.4	75.2
Electronic components	367	70.3	70.5	70.6	49.4	96.0	81.5	46.9	30.2
Other electrical equipment	361-64,369	71.9	71.4	68.9	67.1	12.1	0.0	62.1	9.1
Transportation equipment	37	43.8	43.3	46.5	43.6	57.1	66.8	2.7	2.0
Motor vehicles and motor vehicles equipment	371	30.6	30.4	30.6	30.2	98.4	85.1	0.2	0.3
Other transportation equipment	373-75,379	78.5	77.8	78.8	24.3	1/	1/	93.2	0.0
Aircraft and missiles	372,376	50.4	50.6	51.1	50.1	52.7	19.3	1.4	8.7
Professional and scientific instruments	38	87.1	87.9	87.2	66.0	74.0	2.8	86.1	5.0
Scientific and mechanical measuring instruments	381-82	84.8	87.0	84.6	86.0	76.7	37.0	26.6	2.0
Optical, surgical, photographic, and other instruments	383-87	88.4	88.1	88.5	56.3	21.9	0.0	87.0	5.2
Other manufacturing industries	21,27,31,39	52.5	48.7	43.2	48.4	0.0	0.0	25.8	0.0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	51.1	49.7	50.7	47.1	38.3	53.7	20.2	12.5

1/ Represents no basis for imputation

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table B-4. Funds for performance of basic research, applied research, and development, by industry and source of funds: 1989

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Industry	SIC code	Total			Basic			Applied		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
		[Dollars in millions]								
Total		101,854	31,292	70,562	3,358	924	2,433	16,683	3,803	12,879
Food, kindred, and tobacco products	20-21	(D)	(D)	1,284	(S)	0	(S)	(D)	(D)	12
Textiles and apparel	22-23	(D)	(D)	(S)	(D)	0	(D)	12	0	11,685
Lumber, wood products, and furniture	24-25	172	0	172	(D)	0	(D)	(D)	0	(D)
Paper and allied products	26	686	0	686	27	0	27	121	0	121
Chemicals and allied products	28	11,466	83	11,383	654	8	(S)	3,436	7	3,429
Industrial chemicals	281-82,286	4,039	79	3,960	232	8	223	(D)	(D)	1,060
Drugs and medicines	283	(D)	(D)	5,164	(S)	0	(S)	(D)	(D)	1,621
Other chemicals	284-85,287-89	(D)	(D)	2,259	52	0	(S)	(D)	(D)	748
Petroleum refining and extraction	13,29	2,066	(S)	2,050	(D)	(D)	72	(D)	(D)	671
Rubber products	30	(D)	(D)	678	17	0	17	(D)	(D)	45
Stone, clay, and glass products	32	(D)	(D)	863	(D)	(D)	169	(D)	(D)	386
Primary metals	33	749	34	715	78	0	(S)	(D)	(D)	176
Ferrous metals and products	331-32,3398-99	(D)	(D)	254	(D)	0	(D)	(D)	(D)	(D)
Nonferrous metals and products	333-36	(D)	(D)	461	(D)	0	(D)	(D)	(D)	(D)
Fabricated metal products	34	800	135	664	23	0	23	(D)	(D)	86
Machinery	35	14,635	1,157	13,478	(D)	(D)	(S)	(D)	(D)	2,375
Office, computing, and accounting machines	357	(D)	(D)	10,780	(D)	(D)	(S)	(D)	(D)	2,037
Other machinery, except electrical	351-56,358-59	(D)	(D)	2,698	65	0	65	(D)	(D)	338
Electrical equipment	36	16,929	5,288	11,641	(D)	(D)	406	(D)	(D)	2,185
Radio and TV receiving equipment	365	84	0	84	(D)	0	(D)	(D)	0	(D)
Communication equipment	366	10,539	4,719	5,820	(D)	22	(D)	(D)	(S)	(D)
Electronic components	367	4,990	532	4,458	(D)	(D)	70	(D)	(D)	1,458
Other electrical equipment	361-64,369	1,316	37	1,279	(S)	(D)	(D)	160	0	160
Transportation equipment	37	36,844	21,761	15,083	561	405	156	3,060	(D)	(D)
Motor vehicles and motor vehicles equipment	371	(D)	(D)	8,725	54	0	54	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	353	3	0	(S)	(D)	0	(D)
Aircraft and missiles	372,376	25,638	19,633	6,005	504	405	99	2,379	1,547	832
Professional and scientific instruments	38	5,743	113	5,630	(D)	(D)	211	616	21	595
Scientific and mechanical measuring instruments	381-82	1,868	(S)	1,858	(S)	0	(S)	(D)	(D)	75
Optical, surgical, photographic, and other instruments	383-87	3,875	103	3,772	(D)	(D)	186	(D)	(D)	521
Other manufacturing industries	27,31,39	(D)	(D)	400	(S)	0	(S)	50	0	50
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	8,286	2,666	5,620	757	475	282	1,560	641	919

See explanatory information and SOURCE at end of table.

Table B-4. Funds for performance of basic research, applied research, and development, by industry and source of funds: 1989

Page 2 of 2

Industry	SIC code	Development			Expenditures not distributed			Percent of expenditures not distributed		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
		[Dollars in millions]								
Total		56,869	18,423	38,446	24,944	8,141	16,803	24	26	24
Food, kindred, and tobacco products	20-21	(D)	(D)	608	246	0	246	(D)	0.0	19.2
Textiles and apparel	22-23	80	(D)	(D)	112	0	112	(D)	0.0	52.3
Lumber, wood products, and furniture	24-25	56	0	56	56	0	56	32.5	0.0	32.5
Paper and allied products	26	260	0	260	279	0	279	40.6	0.0	40.6
Chemicals and allied products	28	4,606	33	4,572	2,771	34	2,736	24.2	41.4	24.0
Industrial chemicals	281-82,286	(D)	(D)	1,459	1,250	33	1,217	30.9	41.1	30.7
Drugs and medicines	283	(D)	(D)	1,957	1,219	3	1,216	(D)	(D)	23.5
Other chemicals	284-85,287-89	(D)	(D)	1,157	303	0	303	(D)	0.0	13.4
Petroleum refining and extraction	13,29	673	3	670	649	12	637	31.4	75.8	31.1
Rubber products	30	(D)	(D)	177	439	0	439	(D)	0.0	64.8
Stone, clay, and glass products	32	(D)	(D)	242	67	0	67	(D)	0.0	7.7
Primary metals	33	(D)	(D)	301	161	1	160	21.5	3.9	22.3
Ferrous metals and products	331-32,3398-99	(D)	(D)	75	113	1	112	(D)	(D)	44.2
Nonferrous metals and products	333-36	(D)	(D)	227	48	1	47	(D)	(D)	10.3
Fabricated metal products	34	(D)	(D)	222	(D)	(D)	334	(D)	(D)	50
Machinery	35	(D)	(D)	(S)	2,088	81	2,006	14	7	15
Office, computing, and accounting machines	357	(D)	(D)	(S)	1,229	0	1,229	(D)	0	11
Other machinery, except electrical	351-56,358-59	1,536	18	1,518	859	82	777	(D)	(D)	29
Electrical equipment	36	9,571	3,027	6,544	3,735	1,229	2,506	22	23	22
Radio and TV receiving equipment	365	(D)	0	(D)	71	0	71	85	0	85
Communication equipment	366	7,027	2,767	4,260	1,804	1,043	761	17.1	22.1	13.1
Electronic components	367	(D)	(D)	1,729	1,361	160	1,201	27.3	30.1	26.9
Other electrical equipment	361-64,369	560	(D)	(D)	499	25	474	37.9	68.8	37.0
Transportation equipment	37	23,397	(D)	(D)	9,826	6,111	3,716	26.7	28.1	24.6
Motor vehicles and motor vehicles equipment	371	(D)	(D)	(D)	3,490	798	2,693	(D)	(D)	30.9
Other transportation equipment	373-75,379	(D)	(D)	(D)	233	52	181	(D)	(D)	51.3
Aircraft and missiles	372,376	16,652	12,421	4,231	6,103	5,260	842	23.8	26.8	14.0
Professional and scientific instruments	38	(D)	(D)	1,790	3,047	13	3,034	53.1	11.6	53.9
Scientific and mechanical measuring instruments	381-82	280	0	280	1,484	5	1,479	79.4	52.0	79.6
Optical, surgical, photographic, and other instruments	383-87	(D)	(D)	1,510	1,563	8	1,555	40.3	7.5	41.2
Other manufacturing industries	27,31,39	249	0	249	(D)	(D)	68	(D)	100.0	17.1
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	2,539	947	2,592	2,430	603	1,827	29.3	22.6	32.5

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

NOTE: The character-of-work estimation procedure was revised for 1986 and later years; hence, these data are not directly comparable with data for 1985 and earlier years. See technical notes for a more comprehensive discussion of this change.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table B-5. Funds for performance of basic research, applied research, and development, by industry and source of funds: 1990

Page 1 of 2

Industry	SIC code	Total			Basic			Applied		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
		[Dollars in millions]								
Total		104,606	30,626	73,980	3,574	967	2,607	17,658	4,101	13,557
										393
Food, kindred, and tobacco products	20-21	(D)	(D)	1,308	131	0	(S)	352	0	352
Textiles and apparel	22-23	(D)	(D)	242	(D)	0	(D)	18	0	18
Lumber, wood products, and furniture	24-25	183	0	183	(D)	0	(D)	(D)	0	(D)
Paper and allied products	26	730	0	730	(D)	0	(D)	(D)	0	(D)
Chemicals and allied products	28	12,344	67	12,277	(S)	(S)	(S)	3,776	6	3,770
Industrial chemicals	281-82,286	4,337	65	4,272	221	(S)	218	(D)	(D)	1,279
Drugs and medicines	283	(D)	(D)	5,366	(S)	0	(S)	(D)	(D)	1,734
Other chemicals	284-85,287-89	(D)	(D)	2,638	(S)	0	(S)	(D)	(D)	(S)
Petroleum refining and extraction	13,29	2,129	(S)	2,113	(D)	(D)	87	696	1	695
Rubber products	30	(D)	(D)	730	28	0	28	(D)	(D)	53
Stone, clay, and glass products	32	(D)	(D)	894	(D)	(D)	190	(D)	(D)	393
Primary metals	33	(D)	(D)	801	(S)	0	(S)	(D)	(D)	(S)
Ferrous metals and products	331-32,3398-99	(D)	(D)	245	(D)	0	(D)	(D)	(D)	67
Nonferrous metals and products	333-36	(D)	(D)	556	(D)	0	(D)	(D)	(D)	(S)
Fabricated metal products	34	778	134	644	25	0	25	98	(D)	(D)
Machinery	35	14,696	916	13,780	(D)	(D)	(D)	(D)	(D)	(D)
Office, computing, and accounting machines	357	(D)	(D)	11,073	(D)	(D)	139	(D)	(D)	1,806
Other machinery, except electrical	351-56,358-59	(D)	(D)	2,707	(D)	(D)	(D)	(D)	(D)	(D)
Electrical equipment	36	17,723	5,592	12,131	423	20	404	3,633	1,351	2,282
Radio and TV receiving equipment	365	93	0	93	(D)	0	(D)	(D)	0	(D)
Communication equipment	366	10,770	4,838	5,932	(D)	(D)	(D)	(D)	(D)	(D)
Electronic components	367	5,432	723	4,709	(D)	(D)	93	(D)	(D)	1,465
Other electrical equipment	361-64,369	1,428	31	1,397	67	0	67	195	0	195
Transportation equipment	37	36,019	21,027	14,992	583	385	198	(D)	(D)	1,718
Motor vehicles and motor vehicles equipment	371	(D)	(D)	8,548	73	0	73	648	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	304	3	0	3	(D)	0	(D)
Aircraft and missiles	372,376	25,356	19,216	6,140	507	385	122	2,672	1,433	1,240
Professional and scientific instruments	38	6,194	99	6,095	(D)	(D)	199	619	19	600
Scientific and mechanical measuring instruments	381-82	2,096	(S)	2,086	(D)	(D)	16	(D)	(D)	78
Optical, surgical, photographic, and other instruments	383-87	4,098	89	4,009	(D)	(D)	184	(D)	(D)	522
Other manufacturing industries	27,31,39	(D)	(D)	472	50	0	50	65	0	65
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9,274	2,686	6,588	851	534	317	1,645	613	1,033

See explanatory information and SOURCE at end of table.

Table B-5. Funds for performance of basic research, applied research, and development, by industry and source of funds: 1990

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Industry	SIC code	Development			Expenditures not distributed			Percent of expenditures not distributed		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
		[Dollars in millions]								
Total		56,474	17,914	38,560	26,900	7,643	19,257	25.7	25.0	26.0
Food, kindred, and tobacco products	20-21	601	0	601	(D)	(D)	224	(D)	100.0	17.1
Textiles and apparel	22-23	79	(D)	(D)	131	0	131	(D)	0.0	54.2
Lumber, wood products, and furniture	24-25	65	0	65	54	0	54	29.6	0.0	29.6
Paper and allied products	26	299	0	299	194	0	294	40.3	0.0	40.3
Chemicals and allied products	28	4,996	23	4,973	2,922	36	2,886	23.7	53.0	23.5
Industrial chemicals	281-82,286	(D)	(D)	1,498	1,312	35	1,277	30.3	54.4	29.9
Drugs and medicines	283	(D)	(D)	1,969	1,319	1	1,318	(D)	(D)	24.6
Other chemicals	284-85,287-89	1,506	0	1,506	291	0	291	(D)	0.0	11.0
Petroleum refining and extraction	13,29	(D)	(D)	748	595	12	583	27.9	77.1	27.6
Rubber products	30	(D)	(D)	168	481	1	481	(D)	(D)	65.9
Stone, clay, and glass products	32	(D)	(D)	238	72	0	72	(D)	0.0	8.1
Primary metals	33	342	(D)	(D)	195	3	192	(D)	(D)	24.0
Ferrous metals and products	331-32,3398-99	63	(D)	(D)	116	2	113	(D)	(D)	46.3
Nonferrous metals and products	333-36	(S)	(D)	(D)	79	1	78	(D)	(D)	14.1
Fabricated metal products	34	281	(D)	(D)	373	38	335	47.9	28.4	51.9
Machinery	35	(D)	(D)	9,520	2,042	100	1,942	13.9	10.9	14.1
Office, computing, and accounting machines	357	(D)	(D)	7,965	1,163	0	1,163	(D)	0.0	10.5
Other machinery, except electrical	351-56,358-59	(D)	(D)	1,555	879	100	779	(D)	(D)	28.8
Electrical equipment	36	9,682	2,929	6,753	3,984	1,293	2,691	22.5	23.1	22.2
Radio and TV receiving equipment	365	11	0	11	76	0	76	82.5	0.0	82.5
Communication equipment	366	6,960	2,689	4,271	1,685	884	801	15.6	18.3	13.5
Electronic components	367	2,051	218	1,834	1,716	399	1,317	31.6	55.2	28.0
Other electrical equipment	361-64,369	660	22	638	507	10	497	35.5	30.4	35.6
Transportation equipment	37	(D)	(D)	9,327	9,353	5,605	3,748	26.0	26.7	25.0
Motor vehicles and motor vehicles equipment	371	(D)	(D)	(D)	3,413	585	2,828	(D)	(D)	33.1
Other transportation equipment	373-75,379	(D)	(D)	(D)	242	61	181	(D)	(D)	59.6
Aircraft and missiles	372,376	16,479	12,440	4,039	5,698	4,959	740	22.5	25.8	12.0
Professional and scientific instruments	38	(D)	(D)	1,939	3,365	9	3,356	54.3	9.1	55.1
Scientific and mechanical measuring instruments	381-82	313	0	313	1,685	5	1,680	80.4	49.1	80.5
Optical, surgical, photographic, and other instruments	383-87	(D)	(D)	1,627	1,680	4	1,676	41.0	4.8	41.8
Other manufacturing industries	27,31,39	282	0	282	(D)	(D)	74	(D)	100.0	15.7
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	4,038	992	3,046	2,740	547	2,193	29.5	20.4	33.3

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

NOTE: The character-of-work estimation procedure was revised for 1986 and later years; hence, these data are not directly comparable with data for 1985 and earlier years. See technical notes for a more comprehensive discussion of this change.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table B-6. Funds for performance of basic research, applied research, and development by industry and source of funds: 1991

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Industry	SIC code	Total			Basic			Applied		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
		[Dollars in millions]								
Total		102,246	25,308	76,938	3,463	918	2,545	19,387	4,053	15,334
Food, kindred, and tobacco products	20-21	1,360	0	1,360	128	0	128	393	0	393
Textiles and apparel	22-23	(D)	(D)	215	(D)	0	(D)	(S)	0	(S)
Lumber, wood products, and furniture	24-25	160	0	160	(D)	0	(D)	51	0	51
Paper and allied products	26	715	0	715	(D)	0	(D)	124	0	124
Chemicals and allied products	28	13,183	89	13,094	644	4	641	4,161	11	4,149
Industrial chemicals	281-82,286	4,433	83	4,350	230	4	226	(D)	(D)	1,376
Drugs and medicines	283	(D)	(D)	6,098	(S)	0	(S)	(D)	(D)	2,017
Other chemicals	284-85,287-89	(D)	(D)	2,646	96	0	96	(D)	(D)	756
Petroleum refining and extraction	13,29	2,245	10	2,235	(D)	(D)	108	(D)	(D)	613
Rubber products	30	(D)	(D)	694	(S)	0	(S)	(D)	(D)	91
Stone, clay, and glass products	32	(D)	(D)	895	(D)	(D)	171	(D)	(D)	418
Primary metals	33	836	17	819	(S)	0	(S)	(D)	(D)	(S)
Ferrous metals and products	331-32,3398-	(D)	(D)	244	(D)	0	(D)	(D)	(D)	(D)
Nonferrous metals and products	333-36	(D)	(D)	575	(D)	0	(D)	(D)	(D)	(D)
Fabricated metal products	34	756	130	626	13	0	13	(D)	(D)	96
Machinery	35	15,089	1,055	14,034	(D)	(D)	271	(D)	(D)	2,193
Office, computing, and accounting machines	357	(D)	(D)	10,527	(D)	(D)	154	(D)	(D)	1,620
Other machinery, except electrical	351-56,358-59	(D)	(D)	3,507	(D)	(D)	117	(D)	(D)	573
Electrical equipment	36	17,279	4,824	12,455	431	7	424	3,655	1,096	2,559
Radio and TV receiving equipment	365	78	0	78	(D)	0	(D)	(D)	0	(D)
Communication equipment	366	10,444	4,212	6,232	(D)	(D)	(D)	(D)	(D)	(D)
Electronic components	367	5,321	595	4,726	(D)	(D)	81	(D)	(D)	1,337
Other electrical equipment	361-64,369	1,436	17	1,419	68	0	68	453	0	453
Transportation equipment	37	32,091	16,217	15,874	498	347	151	3,622	1,683	1,939
Motor vehicles and motor vehicles equipment	371	(D)	(D)	8,998	61	0	61	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	288	6	0	6	(D)	(D)	(D)
Aircraft and missiles	372,376	21,692	15,104	6,588	431	347	84	2,700	1,278	1,422
Professional and scientific instruments	38	6,621	100	6,521	(D)	(D)	197	790	19	771
Scientific and mechanical measuring instruments	381-82	2,150	(S)	2,143	(D)	(D)	12	(D)	(D)	(S)
Optical, surgical, photographic, and other instruments	383-87	4,471	93	4,378	(D)	(D)	185	(D)	(D)	664
Other manufacturing industries	27,31,39	(D)	(D)	414	19	0	19	(D)	(D)	65
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9,642	2,815	6,827	829	534	295	2,314	723	1,591

See explanatory information and SOURCE at end of table.

Table B-6. Funds for performance of basic research, applied research, and development by industry and source of funds: 1991

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Industry	SIC code	Development			Expenditures not distributed			Percent of expenditures not distributed		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
		[Dollars in millions]								
Total		58,941	14,845	44,096	20,454	5,492	14,962	20.0	21.7	19.4
Food, kindred, and tobacco products	20-21	613	0	613	226	0	226	16.6	0.0	16.6
Textiles and apparel	22-23	110	(D)	(D)	44	0	44	(D)	0.0	20.4
Lumber, wood products, and furniture	24-25	(D)	0	(D)	26	0	26	16.2	0.0	16.2
Paper and allied products	26	(D)	0	(D)	241	0	241	33.6	0.0	33.6
Chemicals and allied products	28	5,626	(S)	5,585	2,753	34	2,721	20.9	37.6	20.8
Industrial chemicals	281-82,286	(D)	(D)	(S)	1,280	33	1,247	28.9	39.9	28.7
Drugs and medicines	283	2,378	1	2,377	1,385	0	1,385	(D)	0.0	22.7
Other chemicals	284-85,287-89	(D)	(D)	1,707	88	1	87	(D)	(D)	3.3
Petroleum refining and extraction	13,29	(D)	(D)	848	667	1	666	29.7	10.4	29.8
Rubber products	30	(D)	(D)	169	412	0	412	(D)	0.0	59.4
Stone, clay, and glass products	32	(D)	(D)	253	52	1	52	(D)	(D)	5.8
Primary metals	33	(D)	(D)	351	164	1	164	19.6	0.1	20.0
Ferrous metals and products	331-32,3398-99	(D)	(D)	77	96	1	96	39.1	3.5	39.1
Nonferrous metals and products	333-36	(D)	(D)	(S)	68	0	68	11.5	0.0	11.8
Fabricated metal products	34	(D)	(D)	325	236	44	192	31.2	33.5	30.8
Machinery	35	(D)	(D)	10,454	1,209	94	1,115	8.0	8.9	8.0
Office, computing, and accounting machines	357	(D)	(D)	7,979	774	0	774	(D)	0.0	7.3
Other machinery, except electrical	351-56,358-59	(D)	(D)	2,475	436	94	342	(D)	(D)	9.8
Electrical equipment	36	10,256	2,794	7,462	2,938	927	2,011	17.0	19.2	16.1
Radio and TV receiving equipment	365	(S)	0	(S)	40	0	40	51.9	0.0	51.9
Communication equipment	366	7,095	2,550	4,545	1,380	728	652	13.2	17.3	10.5
Electronic components	367	2,414	236	2,178	1,320	190	1,130	24.8	31.9	23.9
Other electrical equipment	361-64,369	718	(S)	(S)	197	9	188	13.7	54.4	13.2
Transportation equipment	37	20,727	10,141	10,586	7,244	4,046	3,198	22.6	24.9	20.1
Motor vehicles and motor vehicles equipment	371	(D)	(D)	(D)	2,660	6	2,654	(D)	(D)	29.5
Other transportation equipment	373-75,379	(D)	(D)	(D)	216	85	131	(D)	(D)	45.7
Aircraft and missiles	372,376	14,194	9,523	4,670	4,368	3,955	413	20.1	26.2	6.3
Professional and scientific instruments	38	(D)	(D)	2,389	3,171	7	3,164	47.9	7.1	48.5
Scientific and mechanical measuring instruments	381-82	(D)	(D)	471	1,553	0	1,553	72.3	0.0	72.5
Optical, surgical, photographic, and other instruments	383-87	(D)	(D)	1,919	1,617	7	1,610	36.2	7.6	36.8
Other manufacturing industries	27,31,39	(D)	(D)	315	15	0	15	(D)	0.0	3.5
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,80d-07,87	5,444	1,219	4,225	1,056	340	716	11.0	12.1	10.5

KEY: (D) = Data have been withheld to avoid disclosing operations of individual companies.
(S) = Data have been withheld because of imputation of more than 50 percent.

NOTE: The character-of-work estimation procedure was revised for 1986 and later years; hence, these data are not directly comparable with data for 1985 and earlier years. See technical notes for a more comprehensive discussion of this change.

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Response Rates and Mandatory Versus Voluntary Reporting

Detailed unit and item response rates for the 1991 survey are shown in tables B-7 and B-8, respectively.

Current survey reporting requirements divide survey items into two groups: mandatory and voluntary. Response to four data items on the questionnaires (total R&D expenditures, Federal R&D funds, net sales, and total employment) is mandatory, whereas response to the remaining items is voluntary. During the 1990 survey cycle, NSF conducted a test of the effect of reporting on a completely voluntary basis to determine if combining both mandatory and voluntary items on one questionnaire influences response rates. For this test the 1990 sample was divided into two panels of approximately equal size. One panel, the mandatory panel, was asked to report as usual (four mandatory items and the remainder voluntary), and the other panel, the voluntary panel, was asked to report all items on a completely voluntary basis. The result of the test was a decrease in the overall survey response rate to 80 percent from levels of 88 percent in 1989 and 89 percent in 1988. The response rates for the mandatory and voluntary panels were 89 percent and 69 percent, respectively. Detailed results of the test were published in *Research and Development in Industry: 1990* (NSF 94-304).

Table B-7. Unit response rates: Number of companies responding to survey, by industry: 1991

Page 1 of 1

Industry	SIC code	Entire survey panel	
		Number of companies receiving form	Response rate [Percent]
Total		1,648	85.2
Food, kindred, and tobacco products	20-21	62	90.3
Textiles and apparel	22-23	39	87.2
Lumber, wood products, and furniture	24-25	36	86.1
Paper and allied products	26	37	91.9
Chemicals and allied products	28	142	93.7
Industrial chemicals	281-82,286	46	93.5
Drugs and medicines	283	35	94.3
Other chemicals	284-85,287-89	61	93.4
Petroleum refining and extraction	13,29	26	96.2
Rubber products	30	37	86.5
Stone, clay, and glass products	32	25	88.0
Primary metals	33	50	88.0
Ferrous metals and products	331-32,3398-99	23	87.0
Nonferrous metals and products	333-36	27	88.9
Fabricated metal products	34	59	84.7
Machinery	35	279	83.2
Office, computing, and accounting machines	357	93	73.1
Other machinery, except electrical	351-56,358-59	186	88.2
Electrical equipment	36	267	87.3
Radio and TV receiving equipment	365	5	40.0
Communication equipment	366	70	90.0
Electronic components	367	98	88.8
Other electrical equipment	361-64,369	94	86.2
Transportation equipment	37	127	85.0
Motor vehicles and motor vehicles equipment	371	37	81.1
Other transportation equipment	373-75,379	14	78.6
Aircraft and missiles	372,376	76	88.2
Professional and scientific instruments	38	139	77.0
Scientific and mechanical measuring instruments	381-82	72	75.0
Optical, surgical, photographic, and other instruments	383-87	67	79.1
Other manufacturing industries	27,31,39	40	87.5
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	283	80.6

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Table B-8. Item response rates: 1991

[Percent]

Page 1 of 1

Data item	Overall
Sales	84.7
Total employment	84.2
Scientists and engineers	58.6
Federal R&D	51.4
Company R&D	79.3
Total R&D	84.3
Energy R&D	43.0
Pollution abatement R&D	43.3
Foreign R&D	53.7
Contracted out	52.1

SOURCE: National Science Foundation/SRS, Survey of Research and Development in Industry: 1991

Comparability of Statistics

Several procedures have been undertaken to revise data and maintain the reliability of the time series. Revisions affecting the comparability of current-year with most recent prior-year statistics and historical statistics are explained below.

Two-Year Comparability

Before the survey questionnaires are mailed each year, Census imprints the data reported by the respondent the previous year (or 2 years earlier for items asked only in odd-numbered years). Respondents are asked to adjust data for the previous year(s), if necessary, to make them comparable to data provided for the current year. Such adjustments are necessitated by any of several developments, e.g., changes in company structure such as mergers, acquisitions, or divestitures; changes in reporting concepts; and even correction of any errors that may have been made previously. Thus, there is comparability in the reporting of survey data over any 2-year period.

These adjustments can be examined by comparing data for the same year reported in two succeeding periods, e.g., 1990 data appearing in *Research and Development in Industry: 1990* may differ from 1990 data in this volume. Totals for broad classifications are likely to be very close in the two editions; differences may be more noticeable in the finer detail. These differences underscore the point that the measures are approximate and indicative rather than precise.

Historical Revisions

The published industry R&D survey statistics are revised periodically, usually because of changes in the SIC code classifications of companies. In addition, other major revisions have been made. Reasons for revisions are discussed below.

Companies may shift from one SIC code into another because of (1) the growth or decline of product lines; (2) the merger of two or more companies; (3) the acquisition of one company by another; (4) divestiture; or (5) the formation of conglomerates. When Census is aware of the year in which changes (2), (3), (4), or (5) occurred (respondents are asked on the questionnaire about changes in ownership), the firm's data are reclassified into the new industry for the year the change actually occurred. If a change is not discovered until a new sample is selected or if it cannot be determined when a change actually occurred (i.e., (1)), other methodologies are used to adjust, or backcast, the data to reflect the move of a company out of one industry and into another.

1. The 1967-76 Period

The SIC codes assigned to companies in the panel for the years 1967 through 1975 were based on data reported in the 1967 economic census. The 1974 Standard Statistical Establishment List file was used to assign SIC codes to companies in the next panel chosen for the 1976 survey. These codes were used to revise 1975 data received in the 1976 survey. The SIC codes of companies in the 1967 and 1976 panels were examined to determine which companies had changed classifications. Since it was not known in which year changes actually occurred, data for companies that had changed SIC codes were revised for the years 1968 through 1974, to smooth the changes over the period 1967-76. To illustrate, if a company was originally in SIC A in 1967 but was discovered to be in SIC B in 1974, its data for 1967-74 were allocated between the two industries as follows: for 1967, all of the company's data were retained in industry A; for 1968, 14.3 percent of the company's data were allocated to industry B, and the remainder retained in industry A; for 1969, 28.6 percent were allocated to industry B, and the remainder retained in industry A; and so on until 1974, when all of the company's data were allocated to industry B.

2. The 1976-81 Period

Backcasting revisions in the data for 1976-80 were also made to reflect the classification changes revealed in the new sample drawn in 1981, however, a different methodology was used for the revisions.

When the new panel was selected in 1981, companies were assigned SIC codes from Census' 1981 SSEL and the 1981 Enterprise Files. Prior-period (1980) data were collected in the 1981 survey. These data were presumed to be more accurate than those collected in the 1980 survey, because they reflected not only updated SIC code classifications but were obtained from a larger panel, providing better coverage of U.S.

industry. Data obtained for 1976-80, using the panel selected in 1976, were revised subject to the following constraints:

a. Data for 1976, revised from the 1977 survey, would remain unchanged, since this was the first year of the 1976 panel and since that panel was an accurate reflection of company SIC codes in 1976.

b. Data for 1980 collected in the 1981 survey would be used instead of the 1980 data collected in the 1980 survey.

An algorithm was used to link data from 1976 with those collected in 1981, preserving to the greatest extent possible year-to-year trends in data for each industry by revising data for the years 1977, 1978, and 1979.

The following data elements were adjusted, using the methodologies just described: Funds spent on R&D (total, Federal, company and other, and R&D performed outside the United States); number of full-time equivalent (FTE) R&D scientists and engineers; total and company and other R&D funds as a percent of net sales; and cost per R&D scientist or engineer. No adjustments were made in other data elements.

3. The 1981-86 Period

Similar backcasting revisions in the data were made in 1987 for the industry data previously reported for the years 1981-86. Several other adjustments were made in 1987 in addition to the original methodology described for the revisions made in 1981.

When the 1987 sample was selected, companies were assigned SIC codes from the 1987 SSEL file. Companies in the sample were asked to submit their prior-year (1986) data along with the information collected for the 1987 survey. These new 1986 data were used in lieu of the data originally collected in the 1986 survey because they reflected updated SIC code classifications of companies and also were collected from a much larger sample that was designed to provide better coverage of U.S. industry, particularly the nonmanufacturing portion. Data obtained for 1981-86 using the panel selected in 1981 were revised in 1987, subject to the following constraints:

a. Data for 1981, revised from the 1982 survey, would remain unchanged, since this was the first year the 1981 panel was used, and since that panel was an accurate reflection of company SIC codes in that year.

b. Data for 1986 collected in the 1987 survey would be used instead of the 1986 data collected in the 1986 survey.

There was an increase of $9.3 million between the 1986 data based on the old panel and the 1986 data reported by the new panel identified in 1987. Most of that aggregate revision was caused by the addition of new R&D performing firms identified through the revised sampling procedures in 1987. An algorithm was used to link data from 1981 with those collected in 1987, to the greatest extent possible preserving year-to-year trends that had previously been reported in data for each industry by revising data for the years 1982, 1983, 1984, and 1985.

4. Federal Data for 1986

Data for a merger between two companies were incorrectly processed in the 1988 tabulations, resulting in an overcount of Federal R&D support for industry in the amount of $356 million in 1986. The corrected 1986 industry R&D total (company, Federal, and other funds) is $87,823 million, and the Federal total is $27,891 million. These corrections are reflected in the detailed statistical tables in this report. No revisions to 1988 individual industry statistics that were published were necessary, because statistics for the affected industry were suppressed to avoid possible disclosure of information about operations of individual companies (i.e., these data cells are marked with the symbol "D").

5. Data Reevaluations for 1987

Many of the small firms identified in the 1987 sample were receiving this kind of survey questionnaire for the first time, and some were unaccustomed to reporting financial information rounded to the nearest thousand dollars. Several of these firms, therefore, mistakenly reported their expenditures for R&D in dollars, not thousands of dollars as requested. Consequently, several firms were selected for the 1987 panel based on an incorrectly reported estimate of the size of their R&D program. Many of these firms realized the error when they received the 1988 form with the preprinted 1987 data. The respondents corrected their 1987 data when they submitted the 1988 forms.

Furthermore, for 1988 several of these firms reported that they had no R&D program, even though they had previously reported expenditures for R&D activities in the 1987 survey. After verifying by phone that these firms had no R&D activity, Census staff declared these firms to be out-of-scope and blanked the erroneous information from the 1987 estimates during processing of the 1988 survey results.

Similar reporting errors were encountered during the data collection and processing for the 1989 survey. In addition, review of the 1989 estimates revealed an error in the revision procedure used for firms discovered to be out-of-scope in 1988. This error resulted in only a partial correction for these firms during the 1988 processing. These errors caused Census to take the unusual step of revising the 1987 R&D expenditure estimates during 1989 survey processing. Revisions to other than only previous year data are rarely done, except during sample years when historical adjustments are made to account for shifts in industrial classification.

Survey Definitions[5]

Cost per R&D scientist or engineer - the arithmetic mean of the numbers of FTE R&D scientists and engineers reported for January in 2 consecutive years divided into the total R&D expenditures of the earlier year, with the ratio attributed to the earlier year. (For example, the mean of the numbers of FTE R&D scientists and engineers in January 1991 and January 1992 is divided into total 1991 R&D expenditures for a total cost per R&D scientist or engineer in 1991.)

Employment, FTE R&D scientists and engineers - persons engaged in scientific or engineering work at a level that requires knowledge of physical, life, engineering, or mathematical science, equivalent, at least, to that acquired through completion of a 4-year college program with a major in one of those fields, employed by the company during the January following the survey year. (The statistics in this report show the full-time equivalent (FTE) employment. The FTE is the number of scientists and engineers in the company who are assigned full-time to R&D projects together with the fraction of total work time spent on R&D projects by non-full-time R&D scientists and engineers.)

Employment, total - number of persons domestically employed by R&D-performing companies in all activities during the pay period that includes the 12th of March.

Federally funded research and development centers (FFRDCs): R&D performing organizations administered by industrial, educational, or other institutions on a nonprofit basis, exclusively or substantially financed by the Federal Government. (FFRDCs are supported by the Federal Government either to meet a particular R&D objective or, in some instances, to provide major facilities at universities for research and associated training purposes. R&D expenditures of the FFRDCs administered by industry are included with the Federal R&D data of the industry classification of each of the administering firms. The FFRDCs are listed below.)

Supported by the Department of Energy:

Bettis Atomic Power Laboratory
Westinghouse Electric Corp.
West Mifflin, PA

Hanford Engineering Development Laboratory
Westinghouse-Hanford Corp.
Richland, WA

Idaho National Engineering Laboratory
EG&G Idaho, Inc.;
Argonne National Laboratory, West;
Rockwell International Corp.;
Westinghouse Electric Corp.
Idaho Falls, IA

Knolls Atomic Power Laboratory
General Electric Co
Schenectady, NY

Oak Ridge National Laboratory
Martin Marietta Energy Systems, Inc.
Oak Ridge, TN

Sandia National Laboratories
Western Electric Company, Inc.—Sandia Corp.
Albuquerque, NM

Savannah River Laboratory
Westinghouse Electric Corp.
Aiken, SC

Supported by the National Institutes of Health, Department of Health and Human Services:

NCI Frederick Cancer Research Facility
Program Resources, Inc.
Frederick, MD

Funds for R&D, company (and other) - cost of R&D actually performed within the company and funded by the company itself or by other non-Federal sources via contract; does not include the cost of R&D supported by companies but contracted to outside organizations, such as research institutions, universities and colleges, nonprofit organizations, or (to avoid double-counting) other companies. (Since this is a survey of R&D *performers*, industrial firms that undertake R&D supported by outside organizations do report the funds received in payment for the R&D work they perform. These moneys are classified under the industries of the performing companies.)

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[5] See section D for more detailed definitions contained in the instruction booklet sent to survey respondents

Funds for R&D, Federal - receipts for R&D performed by the company on Federal R&D contracts or subcontracts and R&D portions of procurement contracts and subcontracts.

Funds for R&D, total - operating expenses incurred by a company in the conduct of R&D in its own laboratories or other company owned or operated facilities including wages and salaries, materials and supplies consumed, property and other taxes, maintenance and repairs, depreciation, and an appropriate share of overhead and excluding capital expenditures.

Net sales and receipts - dollar values for goods sold, or services rendered, by R&D-performing companies to customers (outside the company), including the Federal Government, less such items as returns, allowances, freight, charges, and excise taxes. (Domestic intracompany transfers and sales by foreign subsidiaries are excluded, but transfers to foreign subsidiaries and export sales to foreign companies are included.)

Research and development - basic and applied research in the sciences and engineering and the design and development of prototypes and processes, excluding quality control, routine product testing, market research, sales promotion, sales service, other nontechnological activities or routine technical services, and research in the social sciences or psychology.

Basic research - original investigations for the advancement of scientific knowledge not having specific immediate commercial objectives, although such investigations may be in fields of present or potential interest to the reporting company.

Applied research - investigations for the discovery of new scientific knowledge having specific commercial objectives with respect to products or processes. (Applied research differs from basic research chiefly in terms of the objectives of the reporting company.)

Development - technical activities not routine in nature concerned with translating research findings or other scientific knowledge into products or processes. (Not included are routine technical services to customers or other activities excluded above.)

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NATIONAL SCIENCE FOUNDATION
1800 G STREET, N.W.
WASHINGTON, D.C. 20550

OFFICE OF THE
DIRECTOR

FROM THE DIRECTOR
NATIONAL SCIENCE FOUNDATION

The National Science Foundation requests your company's participation in its 1991 Survey of Industrial Research and Development. This annual survey is the only source of detailed information on U.S. industry's research and development (R&D) performance.

Your company's participation is vital to the accuracy of the resulting information. Because R&D expenditures are concentrated in relatively few companies, a completed response is needed from each surveyed firm – there is no good substitute for the information that you can provide. Your company can be assured of complete confidentiality. Survey data will be released only in aggregate form so that responses of individual companies cannot be identified.

Survey results will be made available to government and industry officials, researchers, and other interested individuals. If you would like to receive a copy of the final publication or if you have suggestions for improvements, please contact Mr. John Gawalt, Division of Science Resources Studies, Room L-609, National Science Foundation, Washington, D.C. 20550, or telephone him at (202) 634-4673.

Sincerely,

Walter Massey

Walter E. Massey

Enclosures

RD-1-L2 (3-10-92)

RD-1-L1
(3-92)

UNITED STATES DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, DC 20233-0001

OFFICE OF THE DIRECTOR

FROM THE DIRECTOR
BUREAU OF THE CENSUS

The Bureau of the Census conducts the "Survey of Industrial Research and Development" under sponsorship of the National Science Foundation. These measures of research and development expenditures by industry are important in analyzing and forecasting long-term economic growth, investigating determinants of productivity, formulating tax policy recommendations, and comparing individual research performance against industry averages.

We are enclosing your report form and a file copy for the "Survey of Industrial Research and Development," Report RD-1. To reduce response burden, we alternate between "long" and "short" versions of this reporting form. We are using the "long" version this year to obtain information for calendar year 1991.

We are also enclosing an instruction manual. Please read it carefully, since it provides guidelines for reporting. You may want to refer to it as you complete your report. We recognize that you may not maintain book records for particular items. In such cases, please use carefully prepared estimates.

The law (Title 13, United States Code) authorizes this report. Items 1A and 1B and Columns 2 and 4 of Item 4C are part of the basic statistical program of the Bureau of the Census for manufacturing companies, and reporting of these items is mandatory. Response to the remainder of the inquiries is voluntary; however, we need your cooperation to make the results of the survey comprehensive and accurate. By Section 9 of the same law (Title 13), your report to the Census Bureau is fully confidential. Only sworn Census Bureau employees will see the information you reported, and they will use it only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

Please return the completed form within 60 days. If you have questions concerning this survey, please direct them to the Special Surveys Branch of our Industry Division on (301) 763-5598. If you need additional copies of the report or additional time, please call (812) 288-3331. We appreciate your past cooperation in this important survey and look forward to your continued participation.

Sincerely,

Barbara Everitt Bryant

Barbara Everitt Bryant

Enclosures

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FORM **RD-1(I)**
(3-16-92)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION
WASHINGTON, DC 20233

INSTRUCTIONS FOR SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1991

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GENERAL INSTRUCTIONS

Comprehensive and timely information about the nature and support of corporate research and development activities is an important component in the overall assessment of our nation's scientific and technological resources. The information you provide is used to prepare national measures of industrial research and development not available from any other source. By carefully completing this report, the accuracy of this information is ensured.

Estimates are Acceptable – If you cannot answer a question from your company records, please estimate the answer carefully. Direct any questions regarding this form to the Bureau of the Census, ATTN: Industry Division, Washington, DC 20233-0001 or call (301) 763-5598.

Additional Forms – Photocopies of this form are acceptable. If you require additional forms, write to the Bureau of the Census, 1201 East 10th Street, Jeffersonville, IN 47132-0001 or call (812) 288-3331.

Companies Reporting in Survey for the First Time – Companies which did not report in the 1990 survey are asked to provide figures for both 1990 and 1991. If the company had no R&D expenditures, complete only Item 1. Enter "No R&D" in the "Remarks" section, sign, and return the form.

Figures for Earlier Years are Preposted on the Form – If your company reported for 1990, entries from that form have been copied on the present form. **Please describe in the "Remarks" section (page 3 of the form) the reasons for any substantial increase or decrease in the 1991 figures entered on this form when compared to corresponding 1990 figures.** Examples of such reasons are new government contracts, acquisitions and divestitures, revised accounting method, etc. If you acquired or disposed of a unit performing an important amount of research and development during the 2-year period, please identify the unit in "Remarks," and give the total amount of research and development accounted for by such unit.

Revision of Earlier Year Figures – If your company reported for 1990, entries from that form are pre-printed on the current form. Please revise the 1990 figures to be comparable with 1991 data and explain in the "Remarks" section any significant revisions made.

Report for Your Entire Company – Research and development activities for your entire domestic company should be reported, including all subsidiaries, divisions, etc. Report sales and employment figures for all parts of the company, even those that do not perform R&D, as long as they are located in the 50 states or the District of Columbia.

Period Covered by the Report – Figures should be reported on a calendar year basis. Fiscal year data, however, are acceptable for all items except for employment, provided your fiscal year ends between September and March. Please report employment figures (Items 1B and 3) for the specific time indicated for both of these items.

Geographic Area Covered – The data relate to business firms which operate one or more establishments in one or more of the 50 States or the District of Columbia.

Public reporting burden for this collection of information is estimated to average 19 hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information including suggestions for reducing this burden to Herman G. Fleming, National Science Foundation, 1800 G Street, Washington, DC 20550; and to the Office of Information and Regulatory Affairs, Office of Management and Budget (OMB No. 3145-0027), Washington, DC 20503.

IMPORTANT NOTES

- **Financial information** – Report all financial information in thousands of dollars.
- **Employment information** – Report all employment information in numbers of people.
- **Sales and Employment (item 1)** – Report sales and employment information from all domestic subsidiaries, including those that do not perform research and development.
- **Costs incurred for R&D (item 4)** – Include R&D depreciation and overhead in your estimated costs. Exclude R&D capital expenditures.
- **Costs incurred for R&D (item 4)** – Costs incurred for R&D performed outside the 50 States or the District of Columbia or for R&D contracted out to non-company R&D organizations should not be reported in item 4. Report R&D contracted to non-company R&D organizations in item 13. Report R&D performed outside of the United States in item 14.

▶ Section I – General Company Data

► Item 1 – Sales and Employment for Company

► **Item 1A – Net Sales –** Report net sales and receipts for this company and its domestic subsidiaries. The reported figures should represent value f.o.b. plant after discounts and exclude freight charges and excise taxes.

Include:

- sales of products and services to other companies, individuals, U.S. Government agencies, and foreign countries
- transfers to foreign subsidiaries

Exclude:

- domestic intra-company transfers
- sales by foreign subsidiaries

► **Item 1B – Employment –** Report the number of employees of the company in all activities in the 50 states and the District of Columbia during the pay periods which include March 12 of 1990 and 1991. This figure would be the same as Item 1 of Treasury Form 941, if one Form 941 was filed for the entire company.

▶ Section II – Research and Development Performed within the Company in the United States

► Item 2 – Research and Development Expenditures

Definition of Research and Development – Research and development includes basic research and applied research in the sciences and in engineering, and design and development of prototype products and processes.

For the purposes of this study, research and development includes activities carried on by persons trained, either formally or by experience, in the physical sciences including related engineering, and the biological sciences including medicine, if the purpose of such activity is to do one or more of the following things:

1. Pursue a planned search for new knowledge, whether or not the search has reference to a specific application.
2. Apply existing knowledge to problems involved in the creation of a new product or process, including work required to evaluate possible uses.
3. Apply existing knowledge to problems involved in the improvement of a present product or process.

Research and development includes the activities described above whether assigned to separate R&D organizational units of the company or carried out by company laboratories and technical groups not part of an R&D organization. Reporting the R&D activities of such latter groups may require the use of estimates for some of the questions.

Activities to be excluded from R&D –

- capital expenditures
- routine product testing
- research in social sciences or psychology
- geological and geophysical exploration activities
- technical services such as:
  - quality and quantity control
  - technical plant sanitation control
  - trouble-shooting in connection with breakdowns in full-scale production
  - advertising programs to promote or demonstrate new products or processes
  - assistance in preparation of speeches and publications for persons not engaged in research and development

► **Item 3 – Research and Development Scientists and Engineers –** Scientists and engineers are defined for this survey as all persons engaged in scientific or engineering work at a level which requires a knowledge of physical or life sciences, engineering, or mathematics equivalent to completion of a 4-year college course with a major in these fields, regardless of whether or not they actually hold a degree in this field.

The figure on R&D scientists and engineers will be obtained primarily from two sources:

1. For company laboratories performing only research and development, report the number of scientists and engineers on the rolls in January.
2. For companies whose activities are not solely devoted to research and development, report the proportion of total work time of scientists and engineers that is devoted to research and development. For example, if a company had 60 scientists and engineers in January 1991 and one-fourth of their time was charged to R&D projects, the figure for the number of R&D scientists and engineers for this company would be 15.

► **Item 4 – Costs Incurred for Research and Development Performed within the Company by Major Type and Source of Funds –**

Include:

- wages, salaries, and related costs
- materials and supplies consumed
- R&D depreciation and overhead
- cost of computer software used in R&D activities
- total charges for work done on contract, including profit
- utilities, such as telephone, telex, electricity, water, and gas
- travel costs and professional dues
- property taxes and other taxes (except income taxes) incurred on account of the R&D organization or the facilities they use
- insurance expense
- maintenance and repair, including maintenance of buildings and grounds
- company overhead including: personnel, accounting, procurement and inventory, and salaries of research executives not on the payroll of the R&D organization

Exclude:

- R&D performed abroad (See Item 6), such as Canada and Puerto Rico
- cost of R&D performed by non-company R&D organizations of any kind
- capital expenditures
- patent expense
- income taxes and interest
- the portion of company-held R&D contracts that were subcontracted outside the reporting company
- fellowships, grants, and gifts to promote R&D or the study of science and engineering

Types of Research

► **Item 4A – Basic Research** – Include the cost of research projects which represent original investigation for the advancement of scientific knowledge and which do not have specific immediate commercial objectives, (although they may be in the fields of present or potential interest to the reporting company).

► **Item 4B1 – Applied Research** – Include the cost of research projects which represent investigation in discovery of new scientific knowledge and which have specific commercial objectives with respect to either products or processes.

► **Item 4B2 – Development** – Include the cost of projects which represent technical activity concerned with non-routine problems encountered in translating research findings or other general scientific knowledge into products or process.

Exclude routine technical services to customers or other items excluded from the definitions of total research and development in Item 2.

Type of Activity Included in Development:

- design and operation of pilot plants and semiwork plants
- engineering activity required to advance the design of a product or process so it meets specific functional and economic requirements
- design, construction, and testing of prototypes and models
- designs for special manufacturing equipment and tools
- preparation of reports, drawings, formulas, specifications standard practice instructions, or operating manuals

Type of Activity Excluded from Development

- toolmaking and tool tryout
- production of detailed construction drawings and manufacturing blueprints
- pre-production planning

Methods of Estimating Research and Development Expenditures by Type – (Basic, Applied, and Development) If your company does not keep records that meet or can be allocated to these specific categories, estimate by:

1. Isolating the **projects** that clearly fall in the development category. If your company fabricates products, such development activity will include the design, construction, and testing of prototypes and models. Some defense contracts typically call for several test models. If your company's research and development frequently involves the development of a "process" as in chemicals and petroleum, such development activity would include operations beyond the bench scale, primarily the design and operations of pilot plants or semiworks.
2. Isolating the **organizational units** which have R&D activities that can be readily classified based on the function assigned to the unit. If R&D work is done in production units as well as in various laboratories, it is generally development type.
3. Distributing the **balance** on the basis of a review of individual projects or on the basis of other summaries of the work. Please use the definitions for basic, applied, and development given below.

Source of Funds – Federal and Company

► **Item 4 – Column 2 – Federal Funds**

Include:

- cost of work done on Federal R&D contracts or subcontracts
- R&D portions of procurement contracts or subcontracts

Exclude:

Federal R&D contracts and R&D portions of procurement contracts that you subcontracted to other R&D organizations (including these would cause duplication in the statistical totals, which include data on work actually performed by each company)

► **Item 4 – Column 3 – Company and other funds, except Federal**

Include:

- all company-sponsored research and development performed within the company
- R&D performed under contract from non-Federal sources

Exclude:

- company sponsored research performed outside of the company

► **Item 4E – Company and Other Funds, Except Federal, Budgeted for the Year 1992** – Report the estimated cost of company and other non-federally sponsored R&D that will be performed within the 50 states and the District of Columbia.

► **Item 5 - Costs Incurred for Federal Research and Development by Principal Agency - Distribute the** cost of Federal research and development work (item 4C, column 2) by Federal agency - **If exact figures are** not available by agency, please estimate or apportion according to the number of scientists and engineers working on the Federal projects and/or the costs of Federal programs.

► **Item 6 - Costs Incurred for Research and Development Performed Within the Company by Major Type of Expenses** - If most research and development is performed in units where summaries are regularly prepared by element of cost, base the breakdown of research and development costs upon the records of such units. If existing records do not yield figures for this item, the item may be estimated.

► **Item 6A - Wages and Salaries** - Report the gross earnings paid in calendar year 1991 to employees engaged in research and development (follow the definition of salaries and wages that is used for calculating the withholding tax). Include salaries of officers in the research establishment(s) if a corporation; exclude payments to proprietor or partners if an unincorporated concern. (Scientists and engineers are defined in item 3.) Exclude employee fringe benefits which are to be reported in item 6C - Other Costs.

► **Item 6B - Materials and Supplies** - Report the delivered cost for all purchased materials consumed, whether received from other companies, withdrawn from inventory, or received from other establishments of this company. Include all work that was done for your laboratories and other technical units by non company organizations which are not research and development organizations (for example, model construction by a noncompany model shop). Exclude purchases from other research and development organizations.

► **Item 6C - Other Costs** - Include items related to your research and development activities and not included in items 6A and 6B. Include utilities, books and periodicals, property and other taxes, employee fringe benefits, and company overhead.

► **Item 7 - Fields of Basic Research** - Use the following definitions to help you divide your company's basic research into broad research fields.

► **Item 7A - Chemistry** - Includes inorganic, organo-metallic, organic, and physical.

► **Item 7B - Engineering (Including metallurgy)** - Included aeronautical (including aerospace and space technology), chemical, nuclear, civil, electrical, and mechanical engineering, etc.) and metallurgy and materials.

► **Item 7C - Geological Sciences** - Includes geodesy, hydrology, geochemistry, seismology, soil sciences, etc.

► **Item 7D - Mathematics** - Includes areas such as algebra; foundations and logic; geometry; numerical analysis, etc.

► **Item 7E - Computer Sciences** - Includes activities directed toward enhancing our understanding of computer structures and computational processes to provide bases for the future capabilities for computational solutions of presently intractable problems.

► **Item 7F - Physics** - Includes acoustics; atomic and molecular; condensed matter; elementary particle; nuclear structure; optics; plasma.

► **Item 7G - Astronomy** - Includes laboratory astrophysics; optical astronomy; radio astronomy; theoretical astrophysics; Gamma-ray, neutrino astronomy.

► **Item 7H - Atmospheric Sciences** - Includes aeronomy; solar; weather modification; extraterrestrial atmospheres; meteorology.

► **Item 7I - Oceanography** - Includes biological oceanography; chemical oceanography; physical oceanography; marine geophysics.

► **Item 7J - Biological Sciences** - Includes all sciences (other than clinical medical sciences) which deal with life processes, including plant and animal sciences, biochemistry, cell biology, nutrition, microbiology, physiology, etc.

► **Item 7K - Clinical Medical Sciences** - Includes all sciences concerned with the use of scientific knowledge for the identification, treatment, and cure of disease including internal medicine, neurology, preventive medicine and public health, pathology, pharmacology, psychiatry, dentistry, veterinary medicine, etc.

► **Item 7L - Other Sciences** - To be used for multidisciplinary and interdisciplinary projects which cannot be classified within one of the above primary fields of science.

► **Item 7M - Total Basic Research Cost** - This should be the same as item 4A, column 4.

► **Item 8 - Applied Research and Development by Product Group** - Enter both Federal and total cost of applied research and development by product group. Costs should be entered in the field which is the END PRODUCT for the firm performing the research and development. For example, research and development in very large scale integrated (VLSI) circuits would be classified by a semiconductor firm in product group 25, electronic components and accessories, if the chips are the final product sold by the firm. The same type of microelectronic research and development by a computer firm, however, would be classified in group 19, office, computing and accounting machines, if the chip were intended to be part of a computer which is the firm's end product.

Field of applied research and development are listed below. For those companies familiar with the Standard Industrial Classification (SIC), the 1987 SIC codes are given after each title. Note that the SIC definition here applies to each field of research and development effort, and not necessarily to the overall code in which your company's manufacturing output is classified.

Product Group

Atomic Energy Devices – Applied Research and Development on atomic energy devices should be included with research and development as classified in the categories listed on lines 1 – 34. Examples of the fields of research and development activities on atomic energy devices and the product groups in which such activities should be reported are as follows:

Activity	Product Group Number
Radioactive isotopes and other radiation sources	3
Partially fabricated reactor fuel element materials and control rods	11
Nuclear reactors; reactor components and equipment; core structurals; heat exchangers and condensers; valves; complete reactor fuel elements and control rods for use in propulsion, power plants, and other; and atomic waste casks	14
Fuel handling equipment, control rod drive mechanism and components for power plants, propulsion, and other; pressurizers, components, and auxiliary equipment; and pumps	20
Atom smashers (particle acclerators)	26
Hot laboratory equipment, special instrumentation	31
Accessory instrumentation for reactor control	32

1. **Food and Kindred Products (SIC 20)** – Foods and beverages for human consumption and certain related products such as vegetable and animal fats and oils, and prepared feeds for animals and fowls.

2. **Textile Mill Products (SIC 22)** – Mill preparation of fibers and mill manufacture of yarn, thread, twine etc; manufacture of broadwoven and knit fabric, carpets and rugs; dyeing and finishing fiber, yarn and knit apparel; coating, waterproofing, or otherwise treating fabric; the manufacture of knit apparel; other finished articles from yarn, felt goods, lace goods, bonded fiber fabrics, and miscellaneous textiles.

3. **Basic Industrial inorganic and organic Chemicals (SIC 281 and 286)** – Includes alkalies and chlorine, industrial gases, inorganic pigments, and industrial inorganic chemicals not elsewhere classified (n.e.c). Also includes industrial organic chemicals including gum and wood chemicals, cyclic crudes, and cyclic intermediates, dyes, and organic pigments, and other industrial organic chemicals n.e.c. Includes radioactive isotopes and other radiation sources.

4. **Plastics Materials and Synthetic Resins, Synthetic Rubber, Synthetic and Other Manmade Fibers (SIC 282)** – Includes cellulosic and noncellulosic fibers. Excludes glass which should be included in product group 10.

5. **Drugs (SIC 283)** – Medicinal chem botanical products, and pharmaceutical preparations.

6. **Agricultural Chemicals (SIC 287)** – Fertilizers, agricultural pesticides, and other agricultural chemicals.

7. **All Other Chemicals (balance of SIC 28)** – Explosives, soaps, glycerins, detergents and cleaning preparations, paints and varnishes, toilet preparations, and miscellaneous chemical products.

8. **Petroleum Refining and Related Industries, Oil and Gas Extraction (SIC 13 and 29)** – Excludes geological and geophysical exploration activities.

9. **Rubber and Miscellaneous Plastics Products (SIC 30)** – Fabricated rubber such as industrial and mechanical rubber goods and fabricated plastics products.

10. **Stone, Clay, Glass, and Concrete Products (SIC 32)** – Ceramics, glass, clay products, abrasives and asbestos products, cement, stone products, concrete products, and other nonmetallic mineral products.

11. **Primary Ferrous Products (SIC 331, 332, 3399, and 3462)** – Products of blast furnaces, steel works, rolling and finishing mills, iron and steel castings and forgings. Includes partially fabricated reactor fuel element materials and control rods.

12. **Primary and Secondary Nonferrous Metals (balance of SIC 33 and 3463)** – Primary and secondary smelting and refining of nonferrous metals, rolled, drawn, and extruded nonferrous metals products, castings and forgings.

13. **Ordnance, Except Missiles (SIC 348, 3795)** – Artillery, small arms, ammunition, tanks and parts, etc.

14. **Fabricated Metal Products (SIC 34 except 3462, 3463, and 348, ferrous and nonferrous forgings, ordnance)** – Tinwear, hand tools, nonelectric heating apparatus, fabricated structural metal products, metal stampings, fabricated wire products, etc., core structurals (barrels, cans, boxes, plates, etc.); heat exchangers, steam and barometric condensers; and valves. Nuclear reactors; reactor components and equipment.

15. **Engines and Turbines (SIC 351)** – Steam engines, steam gas and hydraulic turbines, diesel and other internal combustion engines, n.e.c.

16. **Farm and Garden Machinery and Equipment (SIC 352)** – Farm machinery, including tractors for farm use.

17. **Construction, Mining, and Materials Handling Machinery and Equipment (SIC 353)** – Construction mining, and oil field machinery and equipment, elevators, conveyors, hoists, industrial trucks, tractors, trailers, and stackers.

18. **Metal working Machinery and Equipment (SIC 354)** – Machine tools, dies, machine tool accessories, rolling mill machinery, power-driven hand-tools, and wire fabricating machinery and equipment.

19. **Office, Computing, and Accounting Machines (SIC 357)** – Electronic computing equipment; calculating and accounting machines; typewriters; other computing and office machines, (except laboratory scales and balances).

20. Other Machinery, Except Electrical (balance of SIC 35) – Special industrial machinery, except metalworking, such as food products machinery, textile and paper industries machinery, general industrial machinery and equipment, and miscellaneous machinery except electrical. Includes pumps, air and gas compressors, and industrial process furnaces and ovens. Includes atomic fuel holding equipment; control rod drive mechanism and components for use on nuclear reactors.

21. Electric Transmission and Distribution Equipment (SIC 361 and 3825) – Electric measuring instruments and test equipment, power, distribution and specialty transformers, switchgear and switchboard transformers, etc.

22. Electrical Industrial Apparatus (SIC 362) – Electric motors and generators, motor starters and controls, carbon and graphite brushes, electrodes. Nonelectronic capacitors, condensers,and rectifiers.

23. Radio and Television Receiving Equipment, Except Communication Types (SIC 365) – Radio and television sets, home recorders, prerecorded magnetic tapes, microphones, speaker systems, turntables, phonograph records, compact disc players, etc.

24. Communications Equipment (SIC 366) – Telephone and telegraph apparatus, radio and television transmitting, signaling, and detection equipment and apparatus.

25. Electronic Components and Accessories (SIC 367) – Semiconductors, computer logic modules, computer chips. solid state electronic devices, integrated circuits, electronic capacitors, transformers, connectors, cathode ray tubes, solar cells, solid state photovoltaic devices, etc.

26. Other Electrical Machinery Equipment and Supplies (balance of SIC 36) – Household appliances, electric lighting and wiring equipment, atom smashers, and miscellaneous electrical machinery, equipment and supplies.

27. Missiles (SIC 376 part) – Including frames or structures, launching and handling support equipment and work on the missile system as a whole. Exclude electronic guidance control subassemblies and radar which should be reported in product group 32.

28. Space Vehicles (SIC 376 part) – Include frames or structures, launching and handling support equipment and work on the space vehicle as a whole.

29. Aircraft and Parts (SIC 372) – Piloted and unpiloted aircraft and parts of all types, including engines and auxiliary equipment such as landing gear, de-icing equipment, and other auxiliary equipment specifically adopted for aircraft. Exclude radar and radio equipment, electronic sighting devices and aeronautical instruments which should be reported in product group 32.

30. Motor Vehicles and Equipment (SIC 371) – Motor vehicles such as ambulances, fire engines, personnel carriers, amphibian motor vehicles, truck and automobile trailers, and motor vehicle parts and accessories.

31. Other Transportation Equipment (balance of SIC 37 except 3795) – Ship building, boat building and repairing, railroad equipment, motorcycles, bicycles, and parts, etc. Exclude tanks and tank components which are in product group 13.

32. Scientific and Mechanical Measuring Instruments (SIC 381, 382 part) – Engineering, laboratory, scientific, and research instruments, and associated equipment; automatic controls for regulating residential and commercial environments and appliances; industrial instruments for measurement, display, and control of process variables; nonelectric fire detecting systems; totalizing fluid meters and counting devices; instruments for measuring and testing electricity and electrical signals, and radar systems and equipment; accessory instrumentation for reactor control.

33. Optical, Surgical, Photographic, Timing and Other Instruments (SIC 382 part – 387) – Optical instruments and lenses; surgical and medical instruments and apparatus; dental equipment and supplies; ophthalmic goods including contact lenses; optical fire control equipment; photographic equipment and supplies including film and motion picture apparatus; watches, clocks, clockwork operated devices and parts, appliance timers, chronometers.

34. Other – Include computer software and systems engineering development (SIC 7371), paper and allied products (SIC 26), leather and leather products (SIC 31), lumber and wood products (SIC 24), etc. Please write-in category.

► **Item 9 – Cost of Research and Development Performed Within the Company, by State** – Report the cost of research and development for each state in which your company has research and development laboratories or facilities. It is not necessary to calculate separately individual assignments which may be made outside the home state of a particular research staff. As much as 10 percent of the total may, if desired, be reported in line 52 as "Not distributed by state."

► **Item 10 – Research and Development by Functional Category**

► **Items 10A to 10E – Energy Research and Development** – Include all spending for research and development to increase energy resources or capabilities, including the development of energy equipment. Energy research and development can include costs of R&D projects (both product and process) on exploration, extraction, transportation, processing, storage, generation (including conversion), distribution, conservation, etc., of present, new, or improved forms of energy. Record energy R&D spending according to type of energy in Items 10A through 10E.

If R&D spending is for joint or multiple purposes, estimate and report the portion of cost incurred for the energy purpose. In the limited number of cases where the separation of joint (multiple) costs by type of energy cannot be estimate, include the total cost of the R&D project when the primary purpose of the project is energy research and development. If the project is not primarily for energy research and development then exclude all of the project cost.

► **Item 10B4 – "Coal"** – "Synthetic fuels" includes programs designed to convert coal to gaseous and liquid products. "Mining" is composed of programs for developing equipment and techniques to improve the productivity and recovery rates of coal mining.

► **Item 10C3 – "Conservation and Utilization"** – Includes R&D activities undertaken to reduce consumption either at the point of energy use or in the transmission, transportation, storage, and conversion of energy.

Examples of such are research and development undertaken primarily to reduce fuel consumption in manufacturing, to improve the efficiency of transportation of energy products, or to produce an end product which is more efficient in energy consumption.

Item 10D – "All Other Energy" – Includes areas such as wind, waste, hydroelectric, etc. Also include in this category the development of energy equipment which cannot be readily classified in Items 10A to 10C.

Items 10F to 10J – Pollution Abatement Research and Development – Includes R&D spending for the purpose of reducing or eliminating the emission of pollutants. "Pollution" refers to the emission of pollutants to the outside of a firm's property or activities; "abatement" includes prevention, treatment, or recycling.

Exclude costs:

- to contribute to environmental aesthetics
- to increase equipment durability in corrosive environments
- to conserve energy (include as energy R&D in item 10C3)
- to conserve natural resources
- to increase employee comfort, safety, and health

If the only purpose of the R&D spending is pollution abatement, include the total expenditures on the project. If pollution abatement is only one of several purposes, report only the R&D costs associated with pollution abatement. When the separation of joint costs is not feasible, include the total R&D costs for a project if the purpose is primarily (more than 50 percent) for pollution abatement.

If the project is not primarily for pollution abatement purposes, exclude all of the project costs. Also exclude project costs if expected pollution abatement benefits are obtained at no extra cost.

► **Item 10F – Air** – 1. Automotive emissions includes all R&D efforts undertaken to reduce exhaust emissions from automobiles. 2. Electric power plants emissions includes efforts directed toward reducing airborne emissions from electric power plants. 3. "All other" includes efforts directed at removing sulfur oxide, nitrogen oxides and particulates, and other fossil-fuel pollutants from the atmosphere.

► **Item 10G – Water** – Includes R&D spending on water recirculation or thermal pollution abatement, etc.

► **Item 10H – Solid Waste** – Includes R&D spending on waste compacting devices, etc.

► **Item 10I – Other** – Includes R&D spending on pollution abatement from noise and radiation, etc.

► **Item 11 – Product Versus Process Applied Research and Development** – Data not collected for 1991.

► **Item 12 – Long Versus Short Term Research and Development Costs** – Data not collected for 1991.

► **Section III – RESEARCH AND DEVELOPMENT PERFORMED OUTSIDE THE COMPANY** – (R&D not included in item 4).

► **Item 13 – Total Company Funds Spent for Research and Development Activities Performed Outside the Company Within the United States** – Includes payments for research and development activities in the form of contracts, grants, fellowships, etc., made to other industrial firms, commercial laboratories, consultants, educational institutions, hospitals, research institutions, etc. (Please exclude subcontracting of R&D contracts received from the Federal Government or other companies.)

► **Item 14 – Total Company Funds Spent for Research and Development Activities Performed by Foreign Subsidiaries Outside the United States.**

Report the amount of research and development financed by the U.S. parent or its foreign subsidiaries and performed by company R&D laboratories, branch plants, or other organizations, located outside the United States. Include R&D funds spent in Canada and Puerto Rico. This item excludes R&D activities performed by foreign subsidiaries which were financed by foreign governments or other outside organizations.

NOTE – Foreign subsidiaries are those outside the 50 States or the District of Columbia.

► **Item 15 – Status of This Company on December 31, 1991**

In the "Remarks" section, specify change or correction, e.g., "wholly-owned subsidiary of ABC Company", "merger with XYZ Company", "acquired by 123 Corporation". Provide date of organizational change.

PLEASE RETURN BY

OMB No. 3145-0027: Approval Expires [illegible]

NOTICE — Your report to the Census Bureau is confidential by law (title 13, U.S. Code). It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

RETURN TO
Bureau of the Census
1201 East 10th Street
Jeffersonville, IN 47132-0001

Name of person who supplied 1980 data

Your participation is essential to make the results of this survey comprehensive, accurate, and timely. Response to items 1A and 1B and to item 4C, columns 2 and 4 for 1981 will satisfy the mandatory reporting requirements (title 13, U.S. Code).

CENSUS USE ONLY
SURVEY CODE 4001
INDUSTRY CODE
WEIGHT
STATE
ADDRESS
SIC CODE

FORM **RD-1**
(12-27-81)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION

SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1981

In correspondence pertaining to this report refer to this CENSUS FILE NUMBER (11 digits)

PLEASE RETURN THIS COPY

(Please correct any error in name, address, and ZIP Code.)

GENERAL INSTRUCTIONS

- Please complete this form and return within 60 days in the envelope provided. Retain the file copy for your records. THIS REPORT SHOULD COVER YOUR ENTIRE COMPANY, INCLUDING ALL SUBSIDIARIES, UNLESS OTHERWISE DESIGNATED.
- Enter 0 (zero) where appropriate rather than leaving a blank space.
- Reasonably accurate estimates are acceptable.
- Figures for 1980 are those reported by your company in that year. They are included solely to assist you in reporting 1981 data.
- Figures for 1980 are those reported by your company last year. THE 1980 FIGURES SHOULD BE REVISED, IF NECESSARY, TO BE COMPARABLE WITH 1981 DATA.
- Explain in "Remarks" on the back page any substantial increases or decreases in 1981 figures over 1980 (e.g., new government contracts, acquisitions, mergers, divestitures, etc.)

PLEASE READ ENCLOSED INSTRUCTIONS BEFORE COMPLETING THIS FORM

SECTION I – GENERAL COMPANY DATA

Item 1 – DOMESTIC SALES, RECEIPTS, AND EMPLOYMENT FOR COMPANY	1980	1981
A. Domestic net sales and receipts of this company *(Thousands of dollars)*	101	102
B. Total domestic company employment in all activities during the pay period which includes the 12th of March 1980 and 1981	103	104

SECTION II – RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES

Exclude R&D financed by the company but performed by others. Report such R&D in Section III.

Item 2 – RESEARCH AND DEVELOPMENT EXPENDITURES

Are research and development expenditures for entire domestic company, including subsidiaries, reported on this form? ☐ YES ☐ NO – *Please explain in remarks or on transmittal letter*

Item 3 – NUMBER OF SCIENTISTS AND ENGINEERS INVOLVED IN RESEARCH AND DEVELOPMENT ACTIVITIES Apportion on a full-time equivalent basis. *(See instruction manual)*	January 1981	January 1982
A. Federal research and development		111
B. Company and other research and development		112
C. TOTAL *(Sum of A and B)* →	113	114

Item 4 – COSTS INCURRED FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY BY MAJOR TYPE AND SOURCE OF FUNDS

Include R&D depreciation and overhead; exclude R&D capital expenditures. *(See instruction manual)*

		Thousands of dollars			
		1980	1981		
		TOTAL research and development (1)	Federal funds (2)	Company and other funds, except Federal (3)	TOTAL (Sum of columns 2 and 3) (4)
A. Basic research	If "None," please mark (X) ☐	201	202	203	204
B. Applied research and development	1. Applied research	211	212	213	214
	2. Development	221	222	223	224
	3. TOTAL *(Sum of lines 1 and 2)*	231	232	233	234
C. TOTALS *(Sum of A and B3)* →			242	243	244
D. 1980 TOTALS →			252	253	254
E. Company and other funds, except Federal, budgeted for the year 1982 →				263	

Item 5 – COSTS INCURRED FOR FEDERAL RESEARCH AND DEVELOPMENT BY PRINCIPAL AGENCY *(Breakdown of item 4C, column 2)*	Thousands of dollars		
	1980	1980	1981
1. Department of Defense		N	301
2. National Aeronautics and Space Administration		O T	302
3. Department of Energy		A S	303
4. All other Federal Agencies		K E	304
5. TOTAL COST *(Sum of 1, 2, 3, and 4)* →		D	305

Item 6 – COSTS INCURRED FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THIS COMPANY BY MAJOR TYPE OF EXPENSE	Thousands of dollars		
	1980	1980	1981
A. Wages and salaries of research and development personnel *(Include scientists and engineers, technicians, secretaries, and other personnel)*		N O	311
B. Costs of materials and supplies consumed *(Do not include in this item components, models, and other materials supplied by other research organizations)*		T	312
C. Other costs *(Include service and supporting costs, R&D depreciation, and share of overhead)*		A S K	313
D. TOTAL COSTS *(Sum of A through C) (Same as item 4C, column 4)* →		E D	314

(RD-1-1)

PLEASE CONTINUE ON NEXT PAGE

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FORM RD-1 (Items 7, 8, 9)

SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1981

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION

Refer to this
CENSUS FILE NUMBER
in any correspondence
pertaining to this report

SECTION II – RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES – [illegible]
[illegible]

Item 7 – FIELDS OF BASIC RESEARCH

Allocate the total reported in Item 4A for basic research into the following fields of science and engineering.

	Thousands of dollars 1979	1980	1981
A. Chemistry		↑ NOT ASKED ↓	401
B. Engineering (including metallurgy)			402
C. Geological sciences			407
D. Mathematics			408
E. Computer sciences			409
F. Physics			410
G. Astronomy			411
H. Atmospheric sciences			412
I. Oceanography			413
J. Biological sciences			414
K. Clinical medical sciences			415
L. Other – *Specify*			417
M. TOTAL BASIC RESEARCH COST *(Same as Item 4A, column 4)* →			418

Item 8 – APPLIED RESEARCH AND DEVELOPMENT BY PRODUCT GROUP

Allocate the total reported in 4B, line 3, applied research and development, into the following product groups which represent the END PRODUCT for the firm.

(See instructions on how to classify the applied research and development)

	Thousands of dollars 1979 Federal	1979 Total	1980	1981 Federal	1981 Total
1. Food and kindred products			↑ NOT ASKED ↓	501	502
2. Textile mill products				503	504
3. Industrial inorganic and organic chemicals				505	506
4. Plastics materials and synthetic resins, rubber, and fiber				507	508
5. Drugs				509	510
6. Agricultural chemicals				511	512
7. All other chemicals				513	514
8. Petroleum refining				515	516
9. Rubber and miscellaneous plastics products				517	518
10. Stone, clay, glass, and concrete products				519	520
11. Primary ferrous products				521	522
12. Primary and secondary nonferrous metals				523	524
13. Ordnance, except missiles				525	526
14. Fabricated metal products				527	528
15. Engines and turbines				529	530
16. Farm machinery and equipment				531	532
17. Construction, mining, and materials handling machinery				533	534
18. Metalworking machinery and equipment				535	536
19. Office, computing and accounting machines				537	538
20. Other machinery, except electrical				539	540
21. Electric transmission and distribution equipment				541	542
22. Electrical industrial apparatus				543	544
23. Radio and television receiving sets, except communication types				545	546
24. Communications equipment				547	548
25. Electronic components and accessories				549	550
26. Other electrical machinery equipment and supplies				553	554
27. Missiles				555	556
28. Space vehicles				557	558
29. Aircraft and parts				559	560
30. Motor vehicles and equipment				561	562
31. Other transportation equipment				563	564
32. Scientific and mechanical measuring instruments				565	566
33. Optical, surgical, photographic, and other instruments				567	568
34. Other – *Specify*				571	572
35. TOTAL APPLIED RESEARCH AND DEVELOPMENT COSTS *(Same as Item 4B3, columns 2 and 4)* →				573	574

Item 9 – COST OF RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY, BY STATE

Allocate the totals reported in Item 4C, columns 2 and 4, by the States in which your various research and development laboratories or facilities are located. Estimate costs associated with each State. If necessary, you may report up to 10 percent of your total as "Not distributed by State."

State	Thousands of dollars 1979 Federal	1979 Total	1980	1981 Federal	1981 Total	State	Thousands of dollars 1979 Federal	1979 Total	1980	1981 Federal	1981 Total
1. AL			↑ NOT ASKED ↓	601	602	27. MT			↑ NOT ASKED ↓	653	654
2. AK				603	604	28. NE				655	656
3. AZ				605	606	29. NV				657	658
4. AR				607	608	30. NH				659	660
5. CA				609	610	31. NJ				661	662
6. CO				611	612	32. NM				663	664
7. CT				613	614	33. NY				665	666
8. DE				615	616	34. NC				667	668
9. DC				617	618	35. ND				669	670
10. FL				619	620	36. OH				671	672
11. GA				621	622	37. OK				673	674
12. HI				623	624	38. OR				675	676
13. ID				625	626	39. PA				677	678
14. IL				627	628	40. RI				679	680
15. IN				629	630	41. SC				681	682
16. IA				631	632	42. SD				683	684
17. KS				633	634	43. TN				685	686
18. KY				635	636	44. TX				687	688
19. LA				637	638	45. UT				689	690
20. ME				639	640	46. VT				691	692
21. MD				641	642	47. VA				693	694
22. MA				643	644	48. WA				695	696
23. MI				645	646	49. WV				697	698
24. MN				647	648	50. WI				699	700
25. MS				649	650	51. WY				701	702
26. MO				651	652	52. *				703	704
53. TOTAL COSTS *(Same as Item 4C, columns 2 and 4)* →										705	706

(RD-1-2)

*Not distributed by State

PLEASE CONTINUE ON NEXT

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FORM RD-1 (Items 10 through 16)

SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1981

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION

Refer to this CENSUS FILE NUMBER in any correspondence pertaining to this report

SECTION II – RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES – Continued

Exclude R&D financed by the company but performed by others. Report such R&D in item III.

Item 10 – RESEARCH AND DEVELOPMENT BY FUNCTIONAL CATEGORY
Of the total reported in Item 4C, columns 2 and 4, report the following functional categories.

ENERGY RESEARCH AND DEVELOPMENT Include the project cost or portion of project cost incurred for the purpose of increasing energy resources or capabilities. Include cost by type of energy.	*Thousands of dollars* 1980 Federal funds	1980 Total funds	1981 Federal funds	1981 Total funds	1982 Projected Federal funds	1982 Projected total funds
A. Total nuclear	001	002	003	004	005	006
1. Fission	NOT ASKED	NOT ASKED	007	008	009	010
2. Fusion			011	012	013	014
B. Total fossil fuels	015	016	017	018	019	020
1. Oil	NOT ASKED	NOT ASKED	021	022	023	024
2. Gas			025	026	027	028
3. Shale			029	030	031	032
4. Coal			033	034	035	036
a. Synthetic fuels			037	038	039	040
b. Mining			041	042	043	044
c. All other			045	046	047	048
5. Other fossil fuels			049	050	051	052
C. Total geothermal, solar, conservation and utilization	053	054	055	056	057	058
1. Geothermal	NOT ASKED	NOT ASKED	059	060	061	062
2. Solar			063	064	065	066
3. Conservation and utilization			067	068	069	070
D. All other energy	071	072	073	074	075	076
E. Total of A through D ——→	077	078	079	080	081	082

POLLUTION ABATEMENT RESEARCH AND DEVELOPMENT Include the project cost or portion of the project cost incurred for the purpose of designing pollution abatement products or product characteristics or of designing pollution abatement features into processes. Include cost by form of pollution to be abated.	*Thousands of dollars* 1980 Federal funds	1980 Total funds	1981 Federal funds	1981 Total funds	1982 Projected Federal funds	1982 Projected total funds
F. Air	NOT ASKED	NOT ASKED	901	902	903	904
1. Automotive emissions			905	906	907	908
2. Electric power plant emissions			909	910	911	912
3. All other			913	914	915	916
G. Water			917	918	919	920
H. Solid waste			921	922	923	924
I. Other			925	926	927	928
J. Total of F through I ——→	929	930	931	932	933	934

Item 11 – PRODUCT VERSUS PROCESS APPLIED RESEARCH AND DEVELOPMENT

NO LONGER COLLECTED

Item 12 – LONG VERSUS SHORT TERM RESEARCH AND DEVELOPMENT COSTS

NO LONGER COLLECTED

SECTION III – RESEARCH AND DEVELOPMENT PERFORMED OUTSIDE THE DOMESTIC COMPANY WITH COMPANY FUNDS

(Not included in item 4)

Item 13 – TOTAL COMPANY FUNDS FOR RESEARCH AND DEVELOPMENT ACTIVITIES FINANCED BY THE COMPANY BUT PERFORMED BY OTHERS OUTSIDE THE COMPANY WITHIN THE UNITED STATES Include other industrial firms, colleges and universities, nonprofit organizations, etc. Exclude subcontracting of Federal government and other contracts. *(See instruction manual)*	*Thousands of dollars* [illegible]	1980	1981
		NOT ASKED	971

Item 14 – TOTAL COMPANY FUNDS SPENT FOR RESEARCH AND DEVELOPMENT ACTIVITIES PERFORMED BY FOREIGN SUBSIDIARIES OR BY OTHER ORGANIZATIONS OUTSIDE THE UNITED STATES	*Thousands of dollars* 1980	1981
	972	973

Item 15 – STATUS OF THIS COMPANY ON DECEMBER 31, 1981

A. Was the company listed in the address label owned or controlled by another company on December 31, 1981? ☐ Yes – *Complete item 15B* ☐ No

B. New owner information

Name 985	Date acquired 986
Address *(Number and street)* 987	

City 988	State 989	ZIP code 990

REMARKS – *If more space is required, continue on reverse.*
991

Item 16 – CERTIFICATION – This report is substantially accurate and has been prepared in accordance with instructions.

Key	Name of person to contact regarding this report – *Print or type*	Mo.	Day	Yr
992				

Key	Telephone: Area code	Number	Extension	Signature of authorized official
993				

(RD-1-3)

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